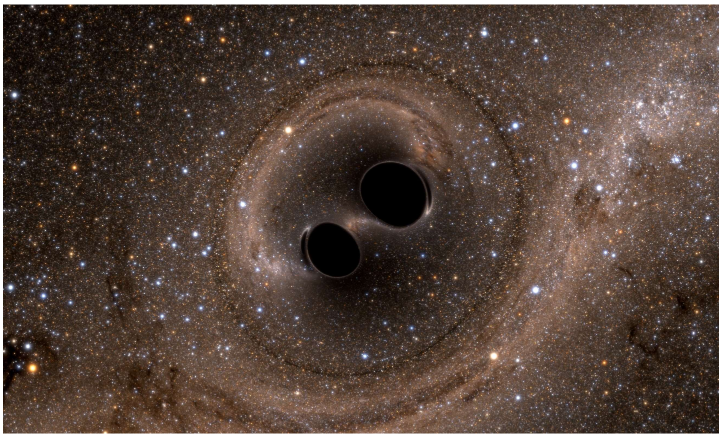


DIMENSIONAL PHYSICS

A theory in which EVERYTHING consists of space-time

EXPOSEE

New approach to a theory of everything in which quantum field theory is derived from general relativity. Every mass-energy equivalent corresponds to a mapping in space-time, a space-time density. A mapping of the space-time density over a low-dimensional transition generates the entire quantum field theory. Black holes are given a much greater role and dark energy is no longer needed because space-time itself represents a potential field.

Christian Kosmak

Würzburg 2025, Germany – Version 5.0

Preface

Dimensional Physics (DP) is a theory that represents everything in the geometry of space-time – not just the curvature of space-time. The aim of DP was to unify the General Theory of Relativity (GR) with quantum field theory (QFT). This aim was partly achieved and partly missed. A kind of “theory of everything” was created.

GR and QFT are given a common basis through their geometric representation in different space-times. Nevertheless, the two theories describe different phenomena. A unified mathematical description of both theories is therefore not possible. This problem arises from the approach of mapping gravity and its cause – energy and mass – completely geometrically in our space-time.

DP leads to a paradigm shift in the way we view space-time. Whether it will trigger a revolution in physics remains unclear. What is crucial is that DP offers new approaches to solving the problem. It opens up a new solution space and creates new starting points for discussions on the fundamental principles of physics

We often simply ask the question: why? We do this until it is clear why a formula or a natural constant looks exactly as it is currently used in the mathematical description. It follows that we question some of the objects of the physical descriptions that a physicist hardly thinks about after the first semester. These include, in particular, the dimensions of space and time, which is the basis of the theory. Hence the name: Dimensional Physics

The present description of DP is structured in 3 parts:

- Part 1: A brief introduction to show the basic idea behind DP
- Part 2: GR and the basics of DP
- Part 3: QFT as a consequence of GR We will often use quantum mechanics (QM) rather than QFT for an explanation. QM is easier to understand in the explanations.

As you can see, abbreviations are introduced in the text. There is a separate list of abbreviations. When counting the dimensions in a space-time, only the spatial dimensions are counted, in contrast to the standard. The reason for this will become apparent from the theory. This text is not a strictly scientific description. In order to make dimensional physics accessible to a broad readership, an explicitly relaxed tone has been chosen.

I hope you enjoy exploring and reflecting. If you have further questions, there is a contact form. Please use this option, thank you (www.dimensionale-physik.de)

Let´s start the journey to a theory in which EVERYTHING consits of space-time

Table of contents

1 Introduction

1.1 Simple fundamental questions

In DP, we want to achieve one of the most difficult things that can be attempted in physics. No, not to unify GR and QFT. That was just a starting point. DP is so well developed that it is clear what we have to do given the current state of physics. We have to rethink some of the fundamentals of physics. Getting someone to do this is incredibly difficult

The level of difficulty is increased even further because DP does not provide a new “highly scientific” mathematical model. Everything we need is already there. We want to achieve a new description of physics using the known mathematical models. That sounds more like Arabian Nights than a physical theory. We will look at the given old descriptions with a new perspective. Similar to a puzzle in which you already know the name of all the puzzle pieces but still cannot solve it. Partial images emerge, but no overall picture. This continues until the moment the liberating idea comes. This is not a 2D puzzle, but a 3D one, and everything fits. In DP, we will need a little more. We will use spacetimes from 4D to 1D (attention! In DP, only the spatial dimensions are counted) in different constellations. This will enable us to solve the physics puzzle

The logical connections in DP are so far-reaching that we can answer the following questions in full:

- Questions about c, h, and G
    - Where do the important natural constants c, h, and G come from?
    - Why can these be converted into one another using the Planck units?
    - Why is there a maximum speed? In GR, this is a postulate without an explanation.
    - Why is there a quantization with h?
- Questions about GR:
    - Is there a singularity in a black hole or at the Big Bang?
    - Where does the equivalence principle come from
    - Where does the relativity principle come from
    - Why can’t the mathematical description be linear?
- Question about QFT:
    - Why can’t QFT be reconciled with GR?
    - Why can QFT be reconciled with special relativity (SR)?
    - Why do probabilities exist?
    - What is entanglement?
- General questions about physics:
    - Why are there symmetries in the mathematical descriptions?
    - Why can we compare different types of forces in the same unit of measurement?

Just stop. A list of questions like this can be as long as you like. We can see that the questions are about the very foundations of physics. The starting point was a unification of GR and QFT. Today, in 2025, we are certain that these two theories, with today’s mathematical description, do not fundamentally match. Therefore, it should come as no surprise that the DP is concerned with precisely these fundamental considerations. If we do not need a new mathematical description and want to create a common basis, then there must be something wrong with the consideration of today’s foundations. This is where we start.

1.2 Starting point: GR or QFT

The starting point was the idea of unification. Unification means to bring different things to an identity. The goal was to achieve this with as few different objects as possible. Taking this idea to the extreme means having a single object. Then there can be no more differences. Where do we start in this search? Here we have two different approaches to choose from:

- We try to expand the known theories
- We build a completely new theory

Starting with a completely new theory was not the focus. The goal was to unify GR and QFT. It is easier to start with the known descriptions. Since GR and QFT are the pillars of modern physics, we choose one of them.

Almost everyone looking for a unification starts with QFT. This makes sense. QFT is the best-confirmed theory we have. In addition, QFT describes all elementary particles and the interactions between them. Only one interaction is missing: gravity. We are certain that all statements about QFT, such as probability, uncertainty, entanglement, linear mapping, etc., are 100% correct. We are equally certain that the GR contains none of this. In addition, the GR contains such ugly things as singularities. Therefore, we assume that the GR is not consistent.

Many brilliant minds have long searched for a unification, starting from QFT. The result has always been identical so far. They were able to improve the mathematical tools and generated knowledge. However, they did not get any closer to the actual solution. Therefore, we choose GR as a starting point, as unlikely as this may sound. What's more, almost everyone who studies physics in depth develops a preference for one of the two theories out of personal preference. For me, it was GR. Therefore, another property is added for the "one object" we are looking for. The mapping on this object should be geometrically describable.

1.3 Basic idea of DP (approach)

We have a rough idea of what we want to achieve and a starting point. Let's take a closer look at GR. To do this, we look at Einstein's field equations. We use the simplest form:

$$\boldsymbol{G_{\mu\nu} = k * T_{\mu\nu}}$$

Oh, the first formula, don't panic. We don't have to be able to solve this equation. It's about the structure and the objects used. On the left side is the Einstein tensor $G_{\mu\nu}$. This describes the curvature of space-time. On the other side, there is a k as a proportionality constant. We will not be interested in this until a later chapter. Then comes the energy-momentum tensor $T_{\mu\nu}$. If you look at this equation with our wish in mind (one object, geometric mapping), then we have already achieved the first half here

What was Einstein's ingenious idea that led to this equation? To no longer understand gravity as a force, but to map it directly geometrically onto exactly one single object, spacetime itself. For us, this means that we develop this idea further and transfer it to the other side. We have to find a geometric mapping in spacetime for the energy-momentum tensor

This means that the field equations on both sides describe a "deformation" of spacetime. One deformation is known as spacetime curvature. We will call the counterpart or source of spacetime curvature spacetime density. This is our approach. We have only one object in the equation, space-time. The equation describes a purely geometric change in space-time for the respective "deformation". This does not change the calculations within the GR. The equation remains as it is. We change our view of the GR. The approach can thus be summarized very simply

Everything consists of space-time

We will obtain different and also an infinite number of space-time configurations in order to be able to map the QFT, but really all descriptions of nature are geometric mappings in a space-time. Currently, there is a mnemonic for GR. It goes something like this: "Matter tells space-time how it has to curve and curved space-time tells matter how it has to move". Here, a clear separation of stage (space-time) and actor (matter) can still be seen. A paradigm shift must take place. The new appropriate saying is:

Space-time is not just a dynamic stage, it is the only actor

1.4 Space-time structure and predictions

The approach that any mass-energy equivalent is a spacetime density and thus a direct mapping in spacetime will lead us to the most important conclusion in DP. Spacetime has limits. Not given by a length or distance, but in structure. Through the SR, we will recognize that a spacetime can lose a spatial dimension and the time dimension. length contraction and time dilation to zero. The mapping of the space-time density across this space-time boundary will forcefully generate all the elements needed for the QFT and explain the structure of the GR:

- The space-time boundary, to lower-dimensional space-times, is the reason why there is a QFT and why it cannot be directly unified with GR. Our space-time alone does not provide the necessary structures for a QFT to be generated. These additional structures will be provided by lower-dimensional space-times.
- The time dimension is not identical across different space-times. Each arbitrary space-time has its own time dimension.
- Each space-time configuration has unique Planck values. You cannot calculate with identical Planck values in different space-times.
- When calculating, it is no longer permissible to simply add or remove a spatial dimension for higher- or lower-dimensional spacetime. These are different objects with different Planck values and separate time dimensions. Therefore, the spacetime boundary is the reason why many new theories do not work from the point of view of DP.
- The higher-dimensional limit (one spatial dimension more but no time dimension) is given by a black hole. The lower-dimensional limit is given by the speed of light. From this it will follow that the gravitational constant G, one of these boundary conditions, is a composite value.
- Purely from the logic of DP, SR is closer to QFT than to GR. Therefore, SR can be unified with QFT, but not GR with QFT.
- The rest mass of an elementary particle is, with the value recognizable to us, the Planck mass in the space-time configuration responsible for the respective particle.
- There are three generations of fermions because in our space-time they have to map onto the three spatial dimensions. There are three low-dimensional interactions because we can only exchange three different geometries between the particles. The number 3, in the classification of particles, or 1/3, in the classification of charges, depends on the number of our spatial dimensions.
- The low-dimensional geometry is exhausted by the standard model of particle physics. There must be no further particle.
- Here is a somewhat "wilder" statement: the Higgs field is almost identical to our space-time. Without gravity, our space-time is a scalar potential field.

The list could be extended by a number of points. However, we can already see from these few points that in the new view of the space and time dimensions, we have to make a fundamental change in the way we deal with these objects. There is a paradigm shift, but without new mathematics. We explain why the given mathematics must look exactly as it does. This is particularly important for QFT.

The points mentioned are all a confirmation of the GR and QFT. There is no deviation in the observations. However, we can make experimentally testable predictions. For example, the last statement, that space-time is a scalar potential field, results in observable changes for cosmology. The early universe must be different in some wah this.ys from our present universe. The latest JWST observations can be explained very well with.

- Many more black holes must be discovered in the early universe than should be possible according to the standard model of cosmology.
- These black holes must be larger than is allowed by today's calculations. The GR does not change, but we still get a higher Eddington limit. Spacetime as a potential field changes the valence of objects, e.g. the momentum (which is also only a spacetime density). In the early and in today's universe, momentum as such is generated identically in a process. However, its valency is different in the respective development of space-time (potential field).
- Dark energy does not exist. Space-time expansion is an intrinsic property of space-time itself. The increase in expansion is due to the fact that the quantum fluctuation can slow down the expansion less and less.

This list could be extended again. However, the topics are covered in detail in the text.

1.5 Mathematics and requirements for the reader

As can be seen from the text of the introduction, more text is used than formulas. It will stay that way. Formulas will be used in their simplest form when necessary. But only when absolutely necessary. A description without mathematics is not possible. To make this text accessible to a wide readership, a simple level of mathematics is aimed for. This means that we are not doing any mathematics here, we describe it better as "shuffling a few formulas". We don't need to be able to mathematically derive or solve formulas like the field equations. But the structure behind them must be explained. The goal is that we always know the why for all natural constants and formulas.

Not every detail from the textbook will be explained from scratch, but the reader should be interested in physics and be able to identify the formula used in the introduction. For physics professionals, it can therefore be "long-winded". The decision has been explicitly made in this direction.

The chapters must be read in the given order. Since the mathematics and the designation of objects do not change, one has a certain idea of this. However, we will assign a different meaning to some objects, e.g. the speed of light. This means that a different meaning cannot be avoided for the same names. Therefore, the order of the chapters must be followed when reading.

1.6 The why is currently more important than the how

It is often assumed that a physicist always wants to clarify the why of a matter. In fact, at universities, only the how, the calculation, is often presented as the most important thing. This is strongly related to QFT, which is said to be the basis of everything. This cannot be explained in a purely logical way. It only works with mathematics. With a lot and complicated mathematics. At the forefront of research into QFT or string theory, the field of work of a physicist or a mathematician can no longer be distinguished. This is precisely where we at DP come in and want to change this. Even a QFT must be understandable from a logical point of view.

In my opinion, a change in the way physicists work occurred about 150 years ago. They did not necessarily have an idea in advance about a topic to be investigated. It was also possible to investigate the model in the form of pure mathematics. New ideas then emerged from this mathematical investigation. With the development of quantum mechanics (QM), this has become the leading approach in physics. This approach, which has been pursued very intensively for over 100 years now, has been extremely successful. Without it, we would definitely not be where we are today in physics. However, I also believe that this path has become overused. We have reached a point where we have to reverse the approach. New ideas are needed, which must then be examined with mathematics

The why and the how are both important. The reasons given are to be understood in such a way that in this description the idea, the why, is considered more important than the mathematical calculation, the how. There must be a compelling logical connection between the descriptions and effects. Especially since we will rethink some of the basics. We explicitly do not want to create a model like QFT, where almost everything is very accurately predictable with very complex calculations. However, one has no idea why this actually reflects the experimental findings.

Enough of a preface and introduction. From here on, everyone should be able to decide for themselves whether it is worth their while to familiarize themselves with the ideas of the DP.

2 Space-time density as a basic idea (approach)

The first development steps for the DP were several different starting points. None of them was this approach, because we are building here. Over time, the various approaches have converged on this point. That was the point when a collection of loose ideas formed a theory.

The basic idea is the continuation of an ingenious thought by Einstein. If gravitation, as a purely geometric description, is mapped onto only one object, spacetime (spacetime curvature), then we must “simply” transfer this idea to everything else.

2.1 Structure of Einstein’s field equations

Since we start from the GR, we get the characteristic equation for the GR in its simplest form. Einstein’s field equations.

$$\boldsymbol{G_{\mu\nu} = k * T_{\mu\nu}}$$

Let’s take a closer look at the structure of the equation.

2.1.1 System of equations

The first thing that stands out: Why the field equations? There is only one equation. This notation is very compact. There are 16 individual equations, which together form a system of equations. The Greek letters μ and v count from 0 to 3 (that is a convention). Each letter represents the number of dimensions in our space-time. According to the textbook, our space-time has 4 dimensions. Three spatial dimensions and one temporal dimension. In fact, there are 4 space dimensions in the equation. The time dimension gets an additional factor that turns time into length. The unit of measurement of the time dimension in the mathematical description is a length and not a time. The time dimension gets a different sign than the spatial dimensions. Space dimensions a plus and the time dimension a minus or vice versa. How this is done is purely a matter of opinion. What is important is that the signs are different. This is called the signature of space-time. We use the signature (- + + +). The capital letters are tensors. They describe how the content of the tensors behaves from one dimension to another. This results in 4 * 4 possibilities, 16 equations. However, due to symmetries, only 10 independent equations are needed.

Contrary to the textbook, we will only count the real space dimensions, i.e. those with +. Thus our space-time is 3D. Why we do this will be explained in chapter 3 “Borders”. We will see that this signature alone is not sufficient to classify space-time. The additional time dimension automatically results in any space-time configuration.

2.1.2 Left-hand side G, the curvature of space-time

The left-hand side of the equation only has the tensor labeled G, the Einstein tensor. This describes, let’s call it quite generally, a deformation of space-time itself. This type of deformation is called the curvature of space-time. In GR, the curvature of space-time is equated with gravitation. Thus, gravity is not a force or an interaction, but a geometric mapping on exactly one single object, space-time. Our approach is to maintain a geometric identity across all considerations of an object. Thus, for gravity, the desired form of description has already been achieved. This immediately raises the question of whether we can do the same for the other side of the equation.

2.1.3 Right-hand side T, the space-time density

We transfer the idea of a mapping in space-time to the other side of the equation. There we have two elements. First, the small k. This is a proportionality constant. It contains only fixed values and thus, in the mathematical sense, represents only a fixed number with the appropriate unit of measurement. We will examine this k later. Then there is the energy-momentum tensor T. This contains everything that is known as the mass-energy equivalent. As with G, it is divided into the respective dimensions in relation to each other.

Without realizing it, the goal has already been achieved. It looks like the opposite. The energy-momentum tensor is a wild collection of everything the universe has to offer except for gravity. How can an equation with such a diverse collection of objects be so clearly represented? Because the collection is not as wild as it looks. If we look at the equation as a unification of GR and QFT, everything becomes clear. G describes gravity and T collects the entire particle zoo from the standard model, plus momentum, charges, etc. We know that the descriptions do not match, and yet we have an equal sign here. For this equation to work and for the difference to QFT to arise, GR must adopt a special view of this collection. The differences must be normalized. As always, this is done via energy. No matter how different the energy contributions from the energy-momentum tensor are, GR must adopt a normalized view. GR may only be interested in two things from T. The amount of energy and the possible alignment with the dimensions. Any “inner structure” of a mass-energy equivalent (is it an electron, photon, proton, etc.) must be hidden.

The Einstein tensor only uses spacetime with a deformation. We will do the same with the energy-momentum tensor. Certain requirements are placed on the geometric mapping in the energy-momentum tensor. The equation must continue to work and all statements of GR on gravity must follow from it. For some of the statements, the mapping to QFT must already fit at this level. That sounds like a very difficult geometric mapping in space-time. Exactly the opposite is the case. We will assume a “density” of space-time itself that is uniformly distributed in a certain volume of space-time. The deformation of space-time for gravity is called space-time curvature. We will now call the deformation of space-time, which is the source of space-time curvature, space-time density. In this case, “density” describes this deformation very well at certain points, but at other points it is rather a hindrance. We have to give it some name.

Force of sovereign arbitrariness => **space-time density**.

We will see that the consequences of this assumption will lead us to a complete description of physics. If someone had told me this before developing the DP, I would have thought that person was crazy. This approach has a great advantage for testing the DP. There is almost no choice for the conclusions. Either the logic and mathematics are correct or the whole theory collapses. There are only very few places where there is still room for “extensions”. The possibilities as in other theories, with smaller structures, higher energies, higher masses, further particles, etc., are not given here.

The only additional assumption to the known physics is the space-time density. What could possibly change? Almost everything, without really having to adjust the mathematics. As I said, it does sound a bit crazy.

2.2 Space-time density

We have invented the space-time density. So we should do two things first:

- A more precise definition of what this space-time density is
- and, at a high level, an initial check to see if the elementary properties of the GR result from it.

2.2.1 Space-time curvature

Let’s not make life more difficult than it is and start with something we already know. Space-time curvature has been known for over 100 years and is well understood mathematically. The space-time density is the source of space-time curvature. Thus, we can see space-time curvature as the reaction of space-time to space-time density. This behavior is described by the field equations. The definition of space-time density must agree with the solutions of the field equations already given.

In this text, we always use the solution of the field equations according to Schwarzschild. This has advantages but also disadvantages. The big advantage is that this solution is the simplest one. Schwarzschild found this solution only a few months after Einstein’s publication. This is a vacuum solution for non-rotating masses. We are sure that this is a strong simplification. But it is sufficient for our purposes.

To understand the solution, we have to write out the signature of spacetime (- + + +) in full. The signature is just a shorthand form of a metric. The metric of spacetime defines the behavior of spacetime with respect to the field equations. If you will, the metric is the solution of the equation. 4 x 4 entries for all the different divisions between the dimensions. Extremely important for us: the metric is the appropriate **definition of the geometry** for space-time. Schwarzschild metric:

$$\begin{matrix} -c^2\left(1-\frac{r_S}{r}\right)dt^2 & 0 & 0 & 0 \\ 0 & +\frac{1}{(1-\frac{r_S}{r})}dr^2 & 0 & 0 \\ 0 & 0 & +r^2 d\theta^2 & 0 \\ 0 & 0 & 0 & +r^2 sin^2(\theta)d\phi^2 \end{matrix}$$

Don’t panic, it looks worse than it is. In the diagonal of this matrix, you can see the signs from the signature (- + + +) first. Behind them, however, there is a term in each case. The last two terms with θ or ϕ are not relevant to us at the moment. This solution is based on spherical coordinates. The last two terms indicate the position on a spherical surface. Like longitude and latitude on the earth’s surface. However, we are only interested in the distance, i.e. the radius of this spherical surface, and not the position on it. Fortunately, in spherical coordinates, the effect of gravity only depends on the distance. This means that only the first two terms are still relevant.

The first term is the time dimension. This can be seen from dt^2 and the minus sign. However, this term is multiplied by c^2. The speed is a length divided by time and the time dimension is only a time. After shortening, only a length remains. The time dimension is converted into a space dimension in the mathematical consideration. There are 4 space dimensions. We stick with the designation from the textbooks and still say time dimension. The small r is the distance from the source of gravity and the r_S is the Schwarzschild radius. The event horizon of the black hole.

The second term is the radial distance to the gravitational source. You don’t have to be a mathematical genius to realize that the second term is the reciprocal of the first term. This means that time and space dimensions behave to the same extent but in opposite directions. If you are far away from the source of gravity, then the distance r of r_S is large and the fraction approaches zero. Thus, there is only one 1 in the parenthesis and we have a flat spacetime and no gravity. However, gravity never becomes exactly zero. This means that gravity has an infinite range. If you approach r_S, then the fraction approaches 1. At the Schwarzschild radius, this is exactly 1. At the time dimension, the parenthesis becomes zero. The time dimension then no longer has any extension/length. Time stands still for a distant observer. At the radial space dimension, the parenthesis also approaches zero. But at zero, the division by zero results in a singularity. A value of infinity, or better, not defined. This is another disadvantage of the Schwarzschild metric. This singularity does not occur at the event horizon with other metrics. It can be shown that this is only a peculiarity of this metric, a mathematical artifact. Since the parenthesis is in the denominator with the radial component, the expansion/length before the Schwarzschild radius approaches infinity.

If the time and space dimensions form a rectangle, the following occurs

Figure 1

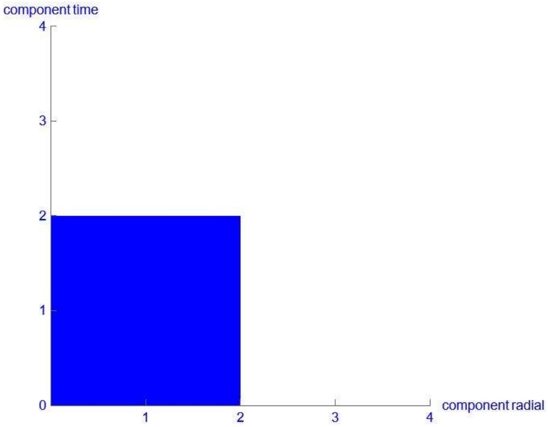


Figure 2

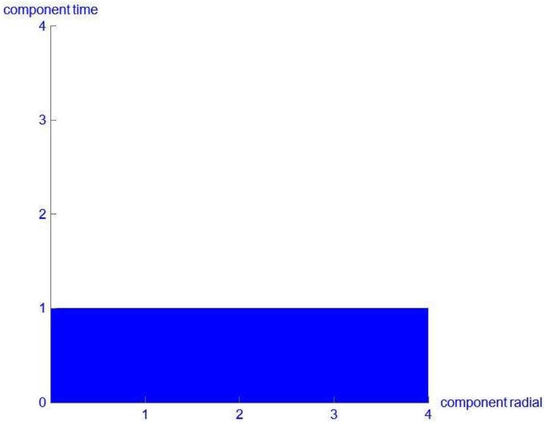


Figure 01 is a spacetime without spacetime curvature. In Figure 02, the time component corresponding to a space component is shortened and the radial space component is lengthened.

The time dimension becomes smaller and the space dimension larger to the same extent. The crucial point in the consideration is that the area of the rectangle does not change. If time is halved, the length doubles => identical area. This consideration of space-time curvature is sufficient for us to be able to justify our space-time density.

2.2.2 Why a density?

Let's stick with a spherically symmetric example. If the radial space component in the direction of the gravitational source is getting longer and longer, where does this additional length go? What you often hear is: into the space-time curvature. We want to describe the space-time curvature as a reaction to the space-time density. Therefore, we reverse the argument. It is easier if we assume that the space-time of the gravitational source has shortened with some deformation. Space-time curvature must compensate for this with additional length. We continue to assume that space-time is a continuum. If you will, because of the continuity of space-time, space-time curvature fills the missing expansion of space-time to space-time density.

Figure 3

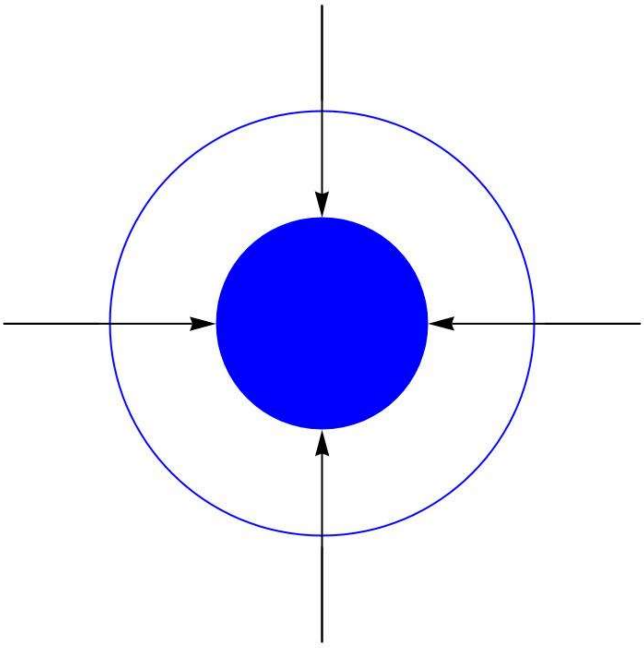


Figure 03: The space-time density has “condensed” the space-time in the circle towards the disk. In the space-time volume (circle), the space-time curvature (arrows) must “push” space-time into this volume through space-time curvature so that the space-time to the space-time density (disk) remains a continuum.

We are considering a volume of spacetime and still have the spherical coordinates. However, in the case of a volume of spacetime, not only one length may become shorter due to deformation. The entire volume of spacetime of the gravitational source must become smaller. We continue to assume that space-time behaves identically when deformed. Then, in addition to the radial spatial dimension, the temporal dimension must also change to the same extent. Not in the opposite direction, otherwise we would not get a smaller volume. In this case, the temporal dimension must shorten to the same extent as the spatial dimension.

Figure 4

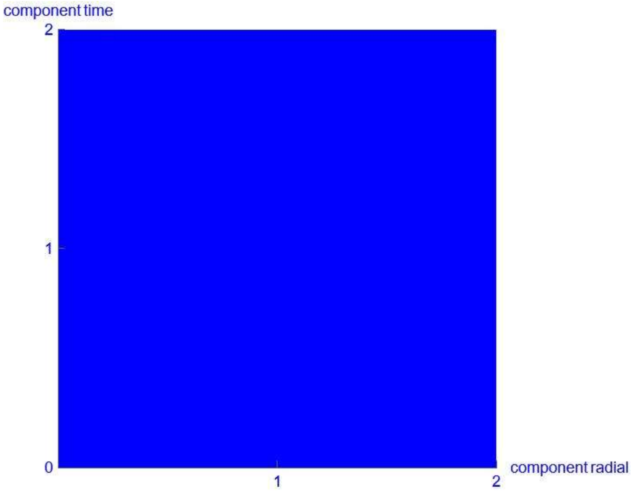


Figure 5

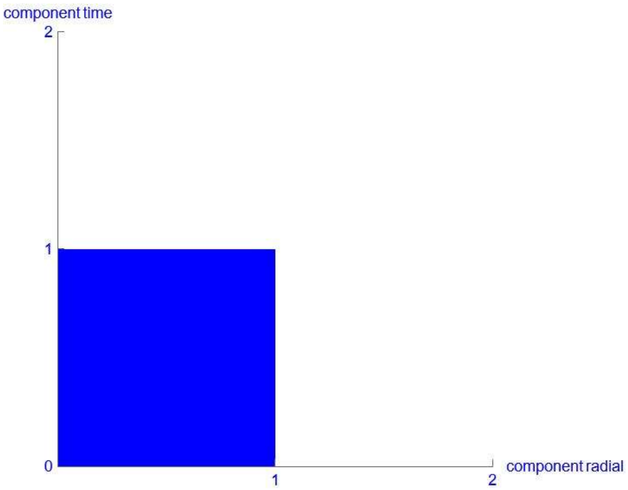


Figure 04 shows a spacetime without spacetime density. In Figure 05, the spacetime must “condense” into a smaller volume .

The deformation of space-time for the gravitational source looks like a “density”. The previously larger area must now be accommodated in a smaller area.

Hence the name: space-time density

2.2.3 What becomes denser in space-time?

How should we visualize this density? With a material such as a sponge, you can easily recognize its density by squeezing it. Does the same thing happen with space-time? Definitely not! When it comes to density, it is helpful to think of a substance. In a substance, you can recognize the density from the outside and also determine it within the substance itself. As with the sponge. But space-time can be deformed. Space-time curvature, space-time density, expansion, twisting of space-time around a black hole or gravitational waves, it all sounds a lot like a changeable substance. This analogy is like the word density. Sometimes it fits and sometimes it doesn’t. Right here, neither substance nor density fits. Because nothing is “squeezed”. We have simply shortened the lengths in the images above. That does not happen. What really happens is that the **definition of geometry** has changed.

Wir zeichnen die zwei Bilder zur Raumzeitdichte nochmal mit den richtigen Einteilungen auf den Koordinaten. Dann sieht es so aus:

Figure 6

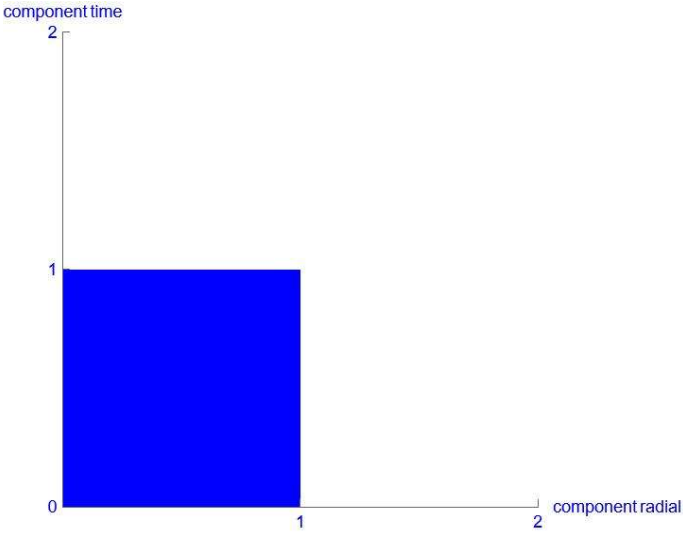


Figure 7

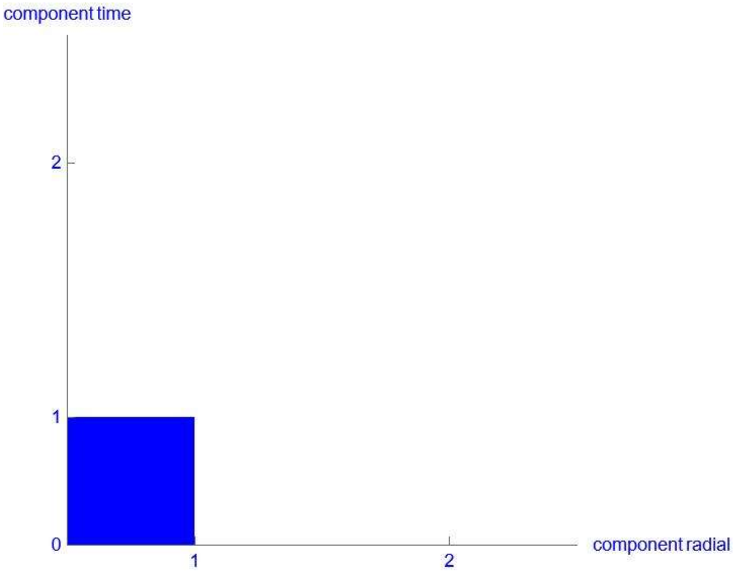


Figure 06 shows a spacetime without spacetime density. Figure 07 has a different scale. Here the unit length from 0 to 1 in the spacetime density is defined differently than outside the spacetime density, e.g. from 1 to 2.

See the difference. The step of a unit of length remains a 1 in both pictures. What has really changed here is how a meter is **defined** for the spatial dimension and a second for the temporal dimension. This only applies within the space-time density. This means that in each rectangle the area is 1. No change locally. Only by comparing the rectangles can you see that the **definition** of time and length must be different.

The spacetime density is actually a **“density of the definition of the geometry of spacetime”** or a **“density of spacetime definition”**. These are long names or obscure abbreviations. We’ll stick with spacetime density. In old versions of DP or in the videos on the YouTube channel “Dimensionale Physik”, I tried to introduce the abbreviation DRD for Density of Space-Time Definition. Just forgot about it again, sorry about that.

Five times in bold **“Definition”**. I hope that has stuck. Nothing is condensed like a substance. In the metric of space-time, there is no classical stretching or density. The definition of what the unit of length 1 meter or the unit of time 1 second is, is changed. This shorter definition is the higher density. Only with the perspective of the definition can we later build a relativity principle in which no change can be detected locally.

We can also do this with the sponge.

Figure 8

Figure 9

Figure 08 and Figure 09 do not show space-time, but a substance. The sponge as a substance with more density.

Figure 10

Figure 11

In Figure 10, we have to imagine the sponge as gone and only see the black line as the length definition. In Figure 11, only the length definition (without the sponge) has been changed.

What has just been said about the density of space-time also applies to the curvature of space-time. Here is the curvature of space-time with the correct divisions when drawing:

Figure 12

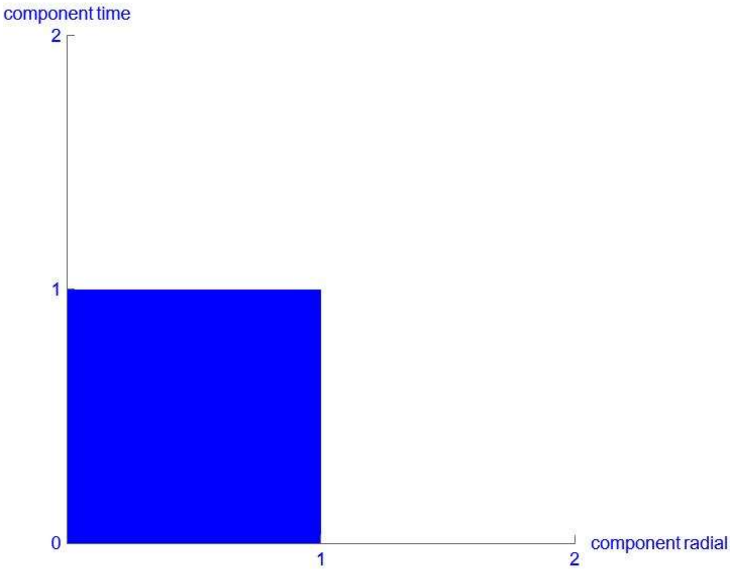
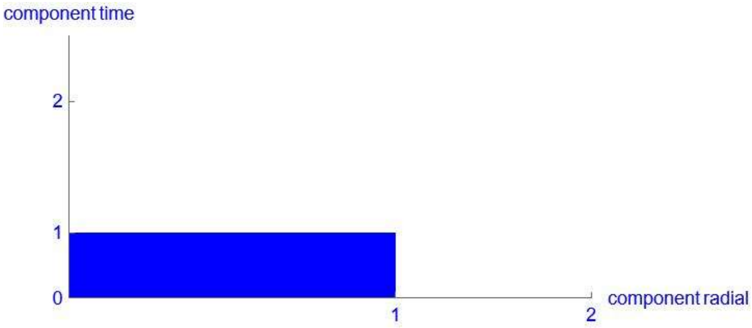


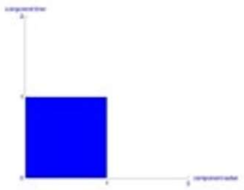
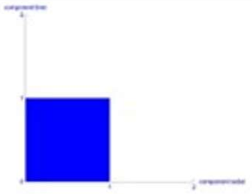
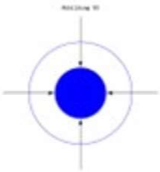
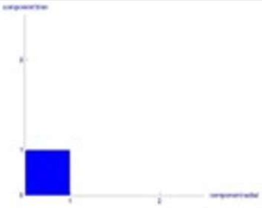
Figure 13



In figures 12 and 13, the space-time curvature is to scale.

There are still more names to define. In the SR, the individual components have been found to be length contraction and time dilation. We will continue to use these terms exactly as they are. For the space-time density on the time dimension, time dilation and on the space dimension, length contraction. When space-time curvature occurs, the time dimension is also defined as becoming smaller, so this is also time dilation. However, there is no separate term for the change in the spatial dimension when space-time is curved. Here, the term space-time curvature is often used directly. From now on, we will use space-time density and space-time curvature only for the behavior of the entire space-time. To keep the same syntax, we will use the term length relaxation for the change in the spatial dimension when space-time is curved.

Figure 14

<table>
<tr><th colspan="3">GR from the DP's perspective</th></tr>
<tr><td colspan="3">$G_{\mu\nu} = k * T_{\mu\nu}$</td></tr>
<tr><td colspan="3">Deformation = Everything is space-time = Deformation</td></tr>
<tr><td>Homogeneous space-time</td><td></td><td>Homogeneous space-time</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>space-time curvature
• time dilation
• length relaxation</td><td></td><td>Space-time density
• time dilation
• length contraction</td></tr>
<tr><td> </td><td></td><td></td></tr>
<tr><td>No change in space-time density
inhomogeneous</td><td></td><td>Change in space-time density
homogeneous</td></tr>
</table>

2.2.4 A brief philosophical digression

Every individual, every planet and even every elementary particle is a spacetime density in just a single object, spacetime. This is continuous. There are no boundaries within spacetime. According to DP, we are all together and, physically speaking, we are just different spacetime densities in a single spacetime. This approach is probably the strongest collective thought we can apply.

The QFT will have a slightly different opinion on this. For the ART, however, this is 100% correct. We should always have this collective thought in mind when dealing with other individuals. According to DP, this is always a way of dealing with ourselves. The thought is as beautiful as it is frightening.

2.3 First test

At the end of this chapter, we want to test our assumption of spacetime density at a high level. We just have to be able to explain the behavior of the GR based on the geometry. The mathematics, the how, is not changed. Our goal is to be able to explain the why of the mathematics. The assumptions that led to the SR and GR the principle of relativity, the speed of light and the equivalence principle will be discussed in separate chapters. This will be the real test. We have to be able to generate these assumptions from our approach. We cannot reuse them, otherwise we get a circular argument. The starting point was already the GR. Let's go through a few points.

2.3.1 Orientation of gravitation

For us, spacetime curvature is the reaction of spacetime to spacetime density. Since the spacetime density "contracts", spacetime as a continuum must compensate for this. Spacetime curvature must necessarily align itself in the direction of spacetime density. In the first approach, spacetime density has no direction. A density can be described as being evenly distributed over the volume.

2.3.2 Mutual Annihilation

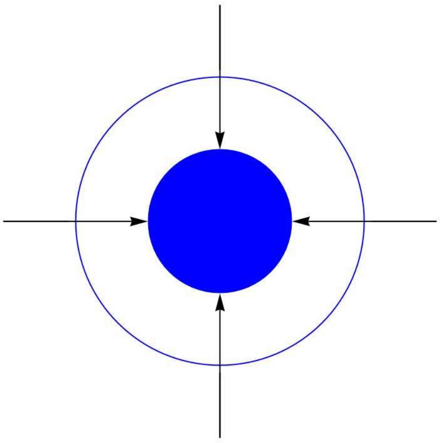
We can rearrange the field equations. We put the Einstein tensor on the same side as the energy-momentum tensor. This transformation is allowed for any equation.

$$\mathbf{0 = k * T_{\mu\nu} - G_{\mu\nu}}$$

Now, the space-time density and the space-time curvature must cancel each other out. A change in sign for a geometric figure is always a change in direction. Thus, the space curvature now pulls away from the space-time density. The space-time density is now "pulled apart" by the space-time curvature (the condensation dissolves). This is no change for the space-time in total, so it is equal to zero.

2.3.3 Infinite range

To do this, let's take another look at Figure 03. Memorize the image well, we will need it again and again.



We see that the space-time curvature deforms the space-time towards the space-time density. Thus, the space-time outside the ring must be pulled/deformed towards the space-time density. Space-time is a continuum and must not "tear".

If something deforms in one direction, then the neighboring area must also deform in this direction. Then the neighboring area of the neighboring area must deform, and so on. Therefore, the space-time curvature must have an infinite range.

The effect of gravity decreases with distance. This must decrease more steeply than linearly. With distance, away from a space-time density, the space-time curvature can access an ever-increasing space-time volume that must deform with it. Therefore, the weakening in our 3D space-time must occur with the square of the distance. In the opposite direction of gravitation, one spatial dimension 1D is added to an increase in volume of two spatial dimensions. If we consider the blue ring as a spherical shell in 3D, then we can place ever larger spherical shells around the space-time density. The radius of the area on which gravity acts grows linearly. However, the area grows with r^2.

2.3.4 Space-time curvature without changing density

We continue with Figure 03. We can see that the space-time must "push" towards the space-time density with the space-time curvature. The space-time must compensate here. Then it only makes sense for the space-time if the pushing-in by the space-time curvature is done in such a way that the space-time density of the surrounding space-time is not changed by the space-time curvature up to the gravitational source. The space-time curvature must therefore be a deformation of the space-time that itself does not produce any change in the space-time density. From the approach with the space-time density, the space-time curvature must show the known behavior (area remains the same).

2.3.5 No resolution of the space-time density

We continue with Figure 03. We can see that the space-time must "push" towards the space-time density with the space-time curvature. Spacetime must compensate here. Right! The beginning repeats itself. This is not a mistake. We need the statements again here.

Spacetime curvature must compensate for the gap between the ring and the disk. But this also means that spacetime curvature must explicitly not compensate into the spacetime density. For spacetime curvature, the end is reached at the boundary of the spacetime density. There is already too much space-time in the space-time density. The space-time curvature must not reach into it and make the problem worse.

Important! The space-time curvature is not there to balance the space-time density. Due to the continuity of space-time, the space-time density must compensate for the missing length to the space-time density. Space-time curvature is not supposed to dissolve space-time density. For space-time curvature, only the amount of space-time density is of interest, since a larger space-time density means that a larger gap has to be filled. Whether space-time density has an "inner" structure is completely irrelevant for space-time curvature and thus for GR. QFT will then describe precisely this "inner" structure.

Spacetime curvature is a compensation for a "spacetime gap" caused by the spacetime density. The spacetime density itself is not changed by spacetime curvature. Spacetime curvature ends at the boundary of the spacetime density. Here you can already see how we get rid of the singularity in GR later. A space-time density without a space-time volume makes little sense. No volume, no density, no gravity, and thus no singularity due to gravity. We will discuss the mathematical abstraction of a point and thus the singularity in detail in Chapter 3, "Borders of Space-Time".

2.3.6 GR non-linear vs. QFT linear

We continue with Figure 03. We can see that the spacetime must "follow up" with the spacetime curvature to the spacetime density. The spacetime must compensate here. Yes, again!

What we can also see is that the spacetime has condensed in a circle through higher spacetime density onto the disk. The space-time density itself is irrelevant for the GR in the disk. The amount of space-time density determines the size of the disk and this is what space-time curvature is interested in. Thus, the space-time density in the disk can be assumed to be uniformly distributed. The description of the space-time density can thus be done in a linear description. This will be one of the reasons why the QFT can be described linearly.

This is not the case with the GR. Space-time curvature does not change the space-time density when it is curved. However, as we can see, space-time "pushes" further space-time towards the space-time density due to space-time curvature. This means that the space-time density in the circle has increased again due to space-time curvature. This gives us a self-reinforcing effect. The mathematical description of GR must not be linear under any circumstances.

All physicists hope that if GR is unified with QFT, GR can possibly also be described linearly from a QFT approach. Linear descriptions are easier to solve. In QFT, the description is linear but extremely complicated from the ground up. It is only because this is a linear description that anything can be calculated at all. The description of GR is not that complicated and is mathematically very well understood. Unfortunately, however, GR is not linear. Thus, in both areas, the supercomputers are busy calculating approximate solutions.

2.3.7 Binding energy

Finally, we select a topic that does not belong to GR. We want to see that the density approach also works in other areas of physics. For this, we select something that exists in many different forms. We want to cover a wide spectrum. In addition, we choose something where no one sees a problem. The point of view in physics should change fundamentally. This also means areas that have supposedly been ticked off as “understood”. The choice has fallen on the binding energy.

The binding energy exists in the atomic nucleus, the atomic shell, between atoms or molecules. Even the release of energy, when two black holes merge, can be explained according to this scheme. The whole structure has less energy than the individual parts before the bond. As an example, we take the fusion of hydrogen to form helium. There are several processes in the sun by which hydrogen turns into helium. We simplify the process a lot. This is sufficient for our purposes.

We assume that hydrogen H_1 turns into hydrogen H_3 and that this then fuses into helium He_4. We are only interested in the end result, the helium nucleus.

QFT calculates the exact probability of this fusion and the energy that must be released for it to occur. The form in which the energy is released is not relevant here. We start our game of questions: Why? Then you often get two answers.

- Systems with less energy are more stable and all systems want to end up at a stable and thus low energy level.
- QFT determines with its calculations that this must happen.

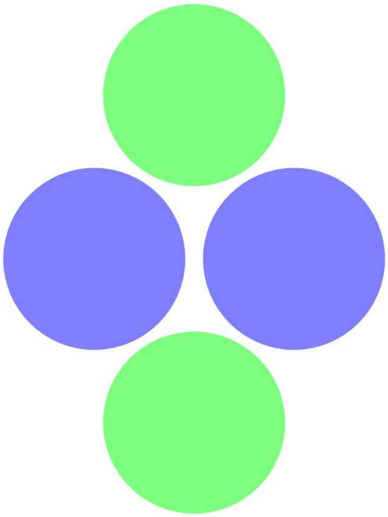
Unfortunately, these are not answers to the question. Why a stable energy level, entropy? We could play the question-and-answer game for a long time here. What is important for us is that:

mathematics is a consistent description of nature through an appropriate model. We can use this model to make investigations and conjectures. However, **mathematics will never create or enforce anything in real nature!** The question why must clarify this and the model description can then provide a suitable how.

How do we explain this with space-time density? The two H_3 building blocks must be in close proximity for a bond to form. Bonding only works at close range. In this case, the two building blocks must come close enough for the strong nuclear force to have an effect. We will clarify the exact process of which nucleons are allowed to react with each other later in QFT

Here, the point is that in the end result, 2 protons and 2 neutrons form a helium nucleus. To illustrate this, textbooks often use a sphere for each nucleon. We will try to do the same here. We will ignore the fact that a proton or a neutron itself is a composite system.

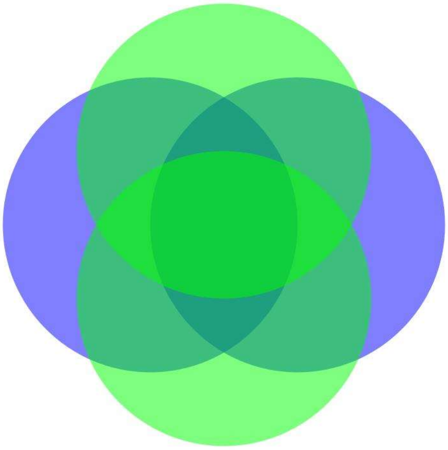
Figure 15



Now we know that the helium nucleus does not look like that at all. Experiments have shown that an atomic nucleus must look more like a single sphere with bulges. The calculations of QFT confirm this. How do we get from 4 individual nucleons to a sphere that is not much larger than the individual nucleons? Fortunately, we have our space-time density.

A spacetime density is not a structure with a closed boundary. Everything is spacetime. This means that individual spacetime densities can overlap. Therefore, bonds only work within a certain spatial proximity. To us, the helium nucleus looks more like this.

Figure 16



The individual nucleons are a space-time density. A space-time density can overlap. Each individual nucleon has **too much space-time density** with the overlap to be a proton or neutron. In order for the nucleons to remain at their level of space-time density, some of the space-time density must go away. There is too much of it! The nucleons do not want to go to a lower energy level. The nucleons must remain at their fixed energy level. If we want to break this nucleus down into its component parts, we have to add the missing space-time density. This is how the space-time density approach explains the binding energy very simply. There is a small overview of the binding energy.

Figure 17

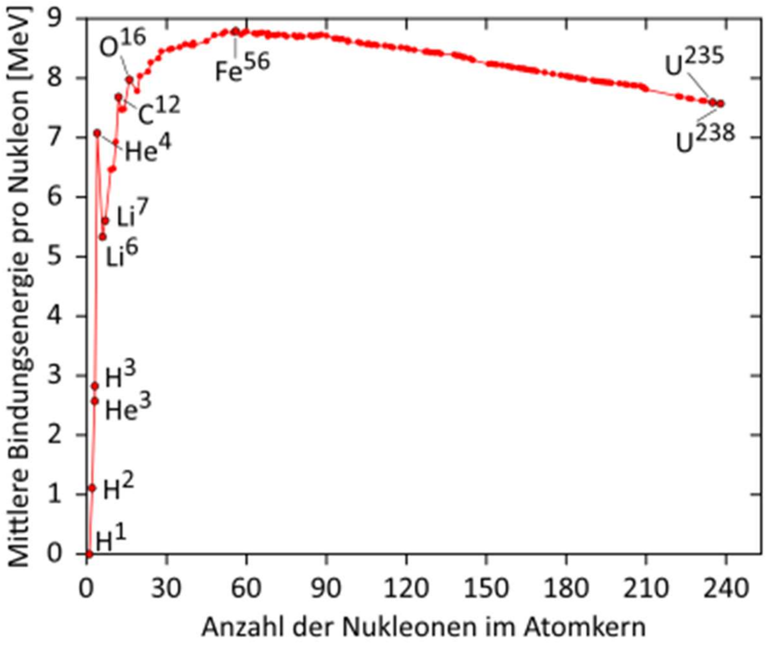


Figure 17 shows the binding energy per atomic nucleus. The horizontal axis is the number of nucleons in the atomic nucleus. The vertical axis is the average binding energy per nucleon [MeV]

source reference: *https://lp.uni-goettingen.de/get/text/6933*

As we can see, the binding energy increases very sharply with a few nucleons. This makes sense, since at the beginning a new large intersection of the space-time density is created with each individual nucleon. The more nucleons already present in the atomic nucleus, the smaller the new intersection between the space-time densities.

At a certain number of nucleons, the binding energy can drop again. The repulsion due to the charge ensures that the nucleons cannot overlap arbitrarily. Therefore, the geometry of the overlap can also cause less binding energy when a new nucleon is added. With iron Fe_{56}, that's it. Each new nucleon causes a smaller intersection due to the change in the intersections between the space-time densities

In addition, there are so-called “magic numbers” 2, 8, 20, 28, 50 and 82. These numbers of nucleons seem to have a very stable bond. According to QFT, when the atomic nucleus is “deformed”, these numbers result in an almost exact sphere for the entire atomic nucleus. A smooth sphere as a whole has the highest possible intersection of nucleons.

As we can see, with the approach of a space-time density, we can also explain the why in areas outside of the GR. With that, we will close this chapter and look at the most important conclusion from the space-time density.

3 Borders of space-time (space-time structure)

In this chapter, we will derive the most important conclusion from the assumption of space-time density. Our space-time and every other space-time has limits. These limits have nothing to do with size, length or volume. These result from one more or less space dimension in a space-time. This will lead us to two conclusions that could not be more different in their statements.

- QFT and lower-dimensional limit: There are an infinite number of lower-dimensional spacetimes with different spacetime configurations. These are mapped by the QFT and generate the entire standard model of particle physics with the interactions. The mathematics remains the same. The spacetime configurations are the fields of the QFT. A new prohibition for calculations will be added at the transition of the dimensional limits. For QFT, this is the perfect result.
- Cosmology and higher-dimensional limit: There are an infinite number of equally dimensional and at least one higher-dimensional space-time. For explanatory approaches in cosmology, this opens Pandora's box. It gives us a huge solution space for ideas about what dark matter, for example, could be. This is almost the worst possible result.

These conclusions arise compellingly from the boundaries of spacetime. We have to live with the consequences, whether we like them or not. Cosmology is given its own chapter in Part 2 and QFT is in Part 3. This chapter is only about the boundaries and structure of our spacetime. That is already enough for a chapter of its own.

3.1 Space-time as a substance or object

We already had a brief mention of spacetime as an object or substance in the last chapter. Since Einstein, it has been a popular point of contention as to whether spacetime is something real or just an abstract mathematical consideration. To better understand the approach with the density, let's choose the idea of substance or, better yet, as a single object. The best argument in favor of substance is the expansion of spacetime.

Example: If the space between our galaxy and a distant galaxy is only a mathematical abstraction, then the galaxies must move away from each other at faster than the light speeds from the Hubble horizon. If we want to prevent a speed faster than light for objects with a rest mass, then space-time must not be a pure mathematical abstraction. If distance and thus space-time are only an abstraction, we cannot decompose the motion of objects into different areas. This can only be avoided if space-time expands as a substance. The speed of light is then not in the space-time (abstract distance), but the space-time itself has this state of motion. This is not a problem for the GR. As I said: curvature, density, expansion, rotation of a black hole and gravitational waves. Our space-time seems to be very "malleable". That must actually be a substance. However, there are places where we have a problem with this analogy:

- When defining the density of space-time as "the definition of the density of space-time geometry". Here, the analogy with a substance is rather a hindrance. The density of space-time does not correspond to the density of a substance. It is the density of a definition of geometry.
- A similar problem later with length contraction in the SR. How can a length in space-time have a genuinely different length for each different observer? A different time for different observers is now accepted. This is a good thing, since it corresponds to the experimental findings. However, the SR is unambiguous. If there is a real different time for the observers, then the length for different observers must also have a real different length. We will be able to explain this in the chapter on relativity. But it is difficult to imagine for a substance.

- At the boundary of space-time, the substance or object does not work well either. In our everyday experience, every object has a boundary and is embedded in a wider surrounding space. This is not correct for space-time. Space-time has a boundary without an equally dimensional surrounding space. Because the boundary lies in the structure of space-time and not in size or extent.

The points can all be resolved by the fact that space-time defines the geometry and thus determines whether a length or time exists at all. Outside of a space-time, no geometry exists. Space-time is a separate object class in itself. To better understand the argument, we start from the analogy of a substance.

3.2 Space-time density extreme

When examining a description, one often starts with the following consideration: What happens at zero or at infinity? We look at the extreme of a space-time density.

3.2.1 Space-time density approaching infinity

Case 1 => infinity: The time and space dimensions approach zero uniformly. Thus, the space-time density increases and approaches infinity. Since both dimensions approach zero, the increase in space-time density must be at least quadratic. In addition, there must be a non-exceedable limit for the “shrinkage” of the time and space dimensions. When we reach zero for the dimensions, that’s it. It can’t go any further. Shortly before this limit, however, the space-time density approaches infinity.

A space-time density that occupies all three spatial dimensions of our space-time can never reach this limit. A given spatial dimension cannot simply disappear. We would have to be able to create an infinite space-time density. We will see that a space-time density of zero or infinity makes no sense. The reverse conclusion: A space-time density that occupies only two space dimensions and is not subject to any interaction must always be located at precisely this uncrossable boundary. Here, a space dimension cannot simply be created. The absence of a space dimension is the defining characteristic of this boundary. This means that there can be space-time densities that are not infinitely large but still exist at this boundary.

What we need is now clear. An absolute boundary that cannot be reached by certain objects and is the condition for existence for others. In addition, we need time dilation towards zero and length contraction towards zero. We know this, exactly the speed of light. We will see that the speed of light belongs to the structure of space-time and is therefore one of the most important natural constants of all.

3.2.2 Space-time density approaching zero

Case 2 => zero: We want the space-time density to approach zero. For this, the time and space dimensions must let their definition of length and time approach infinity. Time relaxation and length relaxation. We had defined these names as such. This “countermovement” to the space-time density will be important again in the chapter on cosmology.

In this chapter, this statement is interesting. We do not get a boundary. The space-time density decreases, but will never become zero. This means that the existence of a space-time point is always connected with the existence of a space-time density.

3.3 Speed of light

According to the textbook, the speed of light c is the fixed maximum speed in our space-time. Thus, it has always been a boundary. What is so special about the DP’s point of view? This limit is a special limit. Let’s take a closer look at the speed of light.

3.3.1 Definition

As the name suggests, the speed of light is a speed. This is defined as lengthtime $\frac{length}{time}$. What numerical value the speed of light has is purely arbitrary. We have defined the specification of one meter and one second and thus the value of the speed of light. Since it is generally accepted that the speed of light is a limit, in physics the definition is reversed. The speed of light is determined and a definition of meter and second is derived from it. From the point of view of DP, the speed of light can be determined very easily. This is the speed at which time dilation and length contraction reach zero. Thus the maximum deformation of space-time for a space-time density.

Why do we get a specific value for the speed of light? It should then be $\frac{length=0}{time=0}$ for the object. This is an undefined mathematical expression and not a specific numerical value. Fortunately, our space-time has more than one spatial dimension. The mapping of the space-time density of an object moving at the speed of light can therefore only exist in the other two spatial dimensions. A space-time density must be mapped there, otherwise the object (e.g. a photon) would not be recognizable.

We already know that it is the Planck length and Planck time. But from the definition, there are infinitely many values for length and time. The speed is a fraction. It could also be, for example, only half the Planck length and half the Planck time. The boundary condition explicitly **does not** set Planck time and Planck length as the smallest possible length and time unit in space-time. It is the combination, i.e. the fraction, that makes up the speed of light. The important result for us is that although it is the boundary condition for our space-time with one less spatial dimension, it is still present in our space-time.

3.3.2 Low-dimensional boundary

An observer recognizes (e.g. for a photon) a movement of the space-time density in the direction of movement with its time exactly on this boundary. For the space-time density, which moves at the speed of light, this definition says something different. If an object exists that has only mapped its space-time density onto two spatial dimensions, then this object cannot perceive our 3D space-time. One spatial dimension must be explicitly missing. But not just one spatial dimension. The temporal dimension is also missing. Like the spatial dimension, this tends towards zero. In the previous interpretation of this fact, it was not seen as anything special. For us, it is different.

One of Einstein’s greatest innovations was to combine space and time into a single object: space-time. Only in this way could the SR and later the GR work. We take this “unity idea” of space-time 100% seriously and apply it to the speed of light. If we want to leave our space-time, then time dilation must go to zero. This is an essential part of space-time. We have time dilation to zero at the speed of light. Now the behavior of the space-time components makes sense. Due to the length contraction, one spatial dimension becomes “less and less or denser”. You change the space-time configuration in the direction from (-, +, +, +) to (-, +, +). In the process, the time dimension also approaches zero due to time dilation and the result is (+, +). This is no longer space-time. There is no time dimension. We have thus left our space-time. From this consideration, we draw our most important conclusion. Our and thus all space-times have boundaries. These are defined by the fact that the time dimension approaches zero.

A space-time has boundaries

We already know one of these boundaries, the speed of light. This is the lower-dimensional boundary. Due to length contraction, we lose one spatial dimension at the speed of light. Thus, we change the spacetime configuration of spacetime and leave our spacetime. This is where the analogy with a substance is wrong. If you change the properties of a substance or an object, it is still the object. Only with different properties. In spacetime, it is different. If we change the spacetime configuration, one spatial dimension more or less, then we leave the spacetime.

Wait a minute! Now you have to object. In our space-time, we know objects that move at the speed of light. How can we recognize these objects if they are no longer in our space-time? We have already answered these questions. Because these objects have a space-time density that can only be mapped onto two spatial dimensions in our space-time. This means that such an object must move at the speed of light, instantly and without any delay, from the moment of its existence. Then, for example, a photon is a real interface object of our space-time. It lies directly on the boundary of space-time. It is only because the images of the space-time density are present on the other two spatial dimensions that we can recognize these objects at all. But then only in the state of the speed of light.

The speed of light is the lower-dimensional limit

3.3.3 Small personal aside

I am personally very pleased with the realization that space-time has limits and that one of them is the speed of light. A long, long time ago, when I was at business school, I had a physics teacher, Mr. Werner. He fulfilled 100% of all prejudices and clichés for a math and physics teacher. Unfortunately, Mr. Werner died before I left school. Towards the end of my first year at school, some of the class sat around a campfire with a beer. It is important to me to emphasize that something like this did not happen during school lessons. Since I was already interested in physics, I asked Mr. Werner how he came to study physics and how he felt about it. He didn't really get on with QM, but found GR very clean and beautiful. However, he had a problem with one point. This was not the singularity. Why is there this maximum speed that we know as the speed of light? Relativity and equivalence principle seemed logical and easy to understand to him. It was clear to him that all this only works if there is this maximum speed. However, the postulate of the speed of light seemed to him to be a "foreign body" in the theory. He would like to have a logical explanation for this.

This question from Mr. Werner has been on my mind ever since that evening and is one of the main reasons why the DP exists. With the approach of space-time density and space-time as an object/substance, this question is answered. The speed of light is not a fixed speed limit. This is a necessary consequence of the approach. There is no "higher" state of motion than the speed of light. The time and space dimension is zero. You can't get less than that. You have to reverse the definition of the speed of light. It is not at the speed of light that time dilation and length contraction become zero. Reaching the lower-dimensional limit of our space-time is the condition for the definition of the speed of light.

The speed of light is a structural element of space-time

There is no reason for a postulate of the speed of light. This automatically results from the approach of the space-time density for a mass-energy equivalent.

3.4 Rest mass and energy

It's nice that I've found my personal peace with the low-dimensional limit. Does this realization help us in other ways? If I ask that question, yes. The low-dimensional limit or speed of light can be chosen as an identical term and explains the hard switch between objects with or without rest mass and what energy is.

3.4.1 Energy = space-time density

As we approach the lower-dimensional boundary, the space-time density approaches infinity. We know the identical behavior from energy. This is no coincidence. In the DP, we equate space-time density and energy. This should be clear from the approach. We have set the space-time density as the source of space-time curvature. The source of space-time curvature is any form of energy. Therefore, the identity between energy and space-time density must necessarily result. But with this, we can explain what energy is. Energy and gravity are another way of defining the geometry of space-time itself.

Energy is the density of the geometric definition of space-time

To deepen this consideration further, we get the most famous formula of Einstein:

$$\boldsymbol{E = mc^2}$$

The formula is correct. However, it is only so well known because the formula is very simple in this form. The complete formula never had a chance to become as well known because it is a bit more complicated:

$$\boldsymbol{E = \sqrt{m^2c^4 + p^2c^2}}$$

If the second term under the root is zero, we can take the root and end up with the familiar part again. For the second term to be zero, the momentum, i.e. the momentum with p^2, must necessarily be zero. The speed of light c is constant and cannot be zero.

3.4.1.1 Rest mass as space-time density

The first term corresponds to the rest mass. We will not go into this in more detail. Why rest mass exists at all is a little more complicated. For this we need the complete part 3, the QFT.

The part of the rest mass that is of interest to us is that it is a scalar value. The rest mass does not depend on a direction.

3.4.1.2 Momentum as a space-time density

We want to look at the second term, the momentum. This means that momentum must also have a direct mapping in the space-time geometry. The whole thing with a direction. For us, this means that there is a space-time density with an oriented direction.

For the colloquial term of density, an special direction sounds a bit strange. In a gas or a liquid, the density is identical in all directions. For spacetime, this is different. Here we only have the definition of geometry for a description. The spacetime density always lies on the time dimension and on at least one space dimension. We will explain why this is so in the section for time. The spacetime density does not necessarily have to be mapped on all space dimensions. We need at least one space dimension, otherwise the term spacetime density makes no sense. This means that a spacetime density with an oriented direction must be an impulse. With angular momentum, the direction is constantly changing, which means a constant change in geometry. We can detect this as a force. However, the spacetime density does not decrease. This is only shifted to another “direction/space dimension”.

3.4.1.3 Spacetime density has many characteristics at the same time

If energy is directed in one spatial dimension and is therefore a momentum and thus a state of motion, then scalar energy, like rest mass, must also have a state of motion. Ok, but in which direction is the motion directed? In all directions simultaneously. We will see in the chapter on cosmology that this is the case, for example, with the expansion of space. Here we can define the following condition:

space-time density is energy, geometry of space-time and state of motion

Space and time were combined into one space-time. We must also do this for these terms. These terms are different descriptions of a single object, the space-time density.

- The geometry describes the direct mapping in space-time as space-time density
- The energy is a summary of the space-time. This has two components. The rest mass as a scalar space-time density and the momentum as a directed space-time density.
- The state of motion is the directed space-time density. A scalar space-time density (rest mass) can then be further condensed in a special direction. This is the momentum. With a special feature at the speed of light. Here the direction comes from the absence of a spatial dimension. However, this direction is also distinguished from the other directions.

The state of motion is the directed space-time density. A scalar space-time density (rest mass) can then be further condensed in a special direction. This is the momentum. With a special feature at the speed of light. Here the direction comes from the absence of a spatial dimension. However, this direction is also distinguished from the other directions.

3.4.2 Rest mass = 3D space-time density

With the previous picture of the space-time density, it is very easy to explain why there are objects with rest mass and a state of motion below the speed of light and objects without rest mass and the exact state of motion at the speed of light.

For an object with rest mass, e.g. an electron, the space-time density must occupy all three spatial dimensions of our space-time. The speed of light is the lower-dimensional limit of space-time. Our space-time loses a spatial dimension. A given spatial dimension cannot simply disappear. It can only receive an ever-increasing directed space-time density up to the speed of light. The scalar space-time density, for example for an electron, becomes more and more dense in the direction of motion. This results in an increasing energy up to infinity. This excludes the achievement of the speed of light.

Space-time density with rest mass = 3 space dimensions are occupied

An object without rest mass may not occupy all three space dimensions under any circumstances. It may only occupy two space dimensions. This means that one space dimension is already missing due to the “internal structure” of the object. The object must not experience any acceleration. It must already be moving at the speed of light from the moment of its existence. Another state of motion is not possible without interaction. The object lives in the low-dimensional interface of our space-time.

Space-time density without rest mass = 2 space dimensions are occupied

From this point, a test for the DP can be generated. If an acceleration phase to the speed of light is ever discovered for an object without rest mass, the DP is falsified.

But, but! The Higgs field gives the particles the rest mass, doesn’t it? Right! Then the Higgs field must correspond to space-time in some form. We will clarify this in part 3.

It is clear that an object is either one or the other. Only in a “conversion process (interaction in QFT)” of the object can the “inner structure (standard model of particle physics)” change. The space-time density can redistribute itself over the spatial dimensions.

Since at the speed of light, the space and time dimensions are already at zero, another space dimension cannot be reduced to zero. The speed of light can only have one direction. From this point, a test for the DP can be created. If a spin with the speed of light is ever discovered for an object, the DP is falsified.

3.4.3 Conditions for the speed of light

We can derive the following conditions from the speed of light, which we equate with the low-dimensional limit:

- Only for objects that occupy 2 spatial dimensions and no time dimension
- The direction of the missing spatial dimension is the direction of motion
- These objects can only move in a straight line in flat spacetime. There may be deviations later in Part 3 about QFT. But these are always instantaneous. The deviation from the straight motion appears to us as "faster than the speed of light".
- A photon or a gravitational wave, as the best-known objects with the speed of light, cannot have components in the direction of motion. In the figure as a wave, these objects must necessarily be transverse waves. Longitudinal is not possible because there is no spatial dimension for a component in the direction of motion.
- No acceleration phase to the speed of light is possible. The speed of light is a condition of existence.
- The speed of light does not exist as a limit because there is a maximum speed. The speed of light is already contained in the structure of space-time.
- An angular momentum can never reach the speed of light. For an angular momentum, all three spatial dimensions must be present.

3.5 Space-time density cannot reach zero or infinity

It has always been one of the big questions: "How should we imagine zero or infinity?" Mathematically, these concepts are now quite well understood. Physically, however, they often lead to "strange" thoughts. We want to clarify this unequivocally. The result will be that neither zero nor infinity can occur within a single spacetime.

The space-time density behaves inversely to the spatial and temporal dimensions. If these decrease, the space-time density increases. Conversely, if the spatial and temporal dimensions increase, the space-time density decreases. Due to this behavior, the space-time density can neither be zero nor infinite.

The SR states that an infinite amount of space-time density is needed to reach the speed of light in one spatial dimension. Why shouldn't this exist? What about space-time itself? Can it reach a zero point? We will clarify these questions here.

3.5.1 Space-time density of zero

The space-time density is a density of space-time itself. A space-time density of zero thus simultaneously means a space-time of zero. Let's take a closer look at this. The approach is a space-time density. The simple existence of at least one space and time dimension already results in a space-time density. Without a space dimension, there can be no mapping as a density. This means for us that there can never be a spacetime point of zero. This spacetime point then contains no expansion on a spatial dimension and is therefore not part of the spacetime at all.

- The existence of a spacetime point always means a spacetime density greater than zero and thus a spacetime volume.
- A space-time density of zero means that this point in space-time does not exist within space-time. This means that this point in space-time is excluded from the consideration.
- A space-time density on the low-dimensional boundary indicates that the mapping of the space-time density in an n-dimensional space-time must be present in n-1 spatial dimensions. No spatial dimension is not possible even in the limit.

3.5.2 The mathematical point

We have used the term "space-time point". We will continue to do so. In physics, a point size is often used and calculated with. This simplifies the idea and especially the calculations. However, anyone who has read carefully up to this point should have gained the following insight:

In DP there is no point

The mathematical abstraction of a point is defined by the fact that a point explicitly has no extension in any spatial dimension. This means that it is not part of space-time. It cannot have a space-time density. Thus, there is no definition of space-time geometry, no energy and no state of motion. Whenever we speak of a point in space-time, a point mass, etc., this is a pure mathematical abstraction to simplify the problem or the calculation. In DP, there can be no point size, of any kind. Let's turn the argument around. It is not GR and QFT that have problems with a point size, but rather the mathematical abstraction of a point has no real representation in physics.

3.5.3 No singularity in GR

GR is often criticized for predicting a singularity in the Big Bang or at the center of a black hole. This is only true if you trace the spacetime density back to a point size. In the case of the Big Bang, the entire spacetime; in the case of a black hole, the mass of that object. In both cases, this is again a mathematical abstraction. Unfortunately, this fact is not included in the field equation of GR. In the Einstein tensor, you can take a space-time curvature to infinity if you assume a point size for the space-time density. But then the space-time density should be gone. A black hole always has a mass in our space-time. The black hole is there, so the space-time density that led to it is there too. This means that there is always a volume of space-time density at the center of a black hole.

In DP there is no singularity

The abstraction of a point has always caused problems. The approach of string theory comes from exactly this. Not a point, but the first mathematical "level" above the point. An object with only one spatial dimension. But it is an approach with a completely separate view of space-time and the content of space-time.

3.5.4 Space-time curvature of zero

We have only considered the space-time density. What about space-time curvature? Can gravity be zero? From what we have discussed so far, yes. To do that, we need a spacetime with an absolutely homogeneous spacetime density. If there is no difference in spacetime density from spacetime point (we continue to use this abstraction) to spacetime point, then there is no spacetime curvature that has to compensate for anything.

But we live in a space-time with different space-time densities, otherwise we could not discuss here. Space-time curvature has an infinite range. If there is only one deviating space-time density, then there is also a space-time curvature. It is therefore clear that space-time curvature is always present in our universe.

3.5.5 Space-time curvature from infinity

We have already seen this. There is no singularity in the DP and therefore no infinite space-time curvature. The compensation of space-time curvature only ever goes as far as space-time density. Space-time density always has a volume. This means that infinite space-time curvature is not possible.

3.5.6 Space-time density of infinity

There is no compelling limit here yet. The speed of light says that an infinite amount of energy is needed up to the lower-dimensional limit. Do we get this from somewhere? Definitely not. There are two arguments for this.

- An infinite amount of spacetime density means that spacetime itself must be infinitely large. Spacetime density is spacetime itself. We can't get an infinite amount out of that. We will see in the following sections, and especially in the chapter on cosmology, that this is ruled out by the definition of the Big Bang.
- Let's leave out the argument about the amount of space-time density and just look at length contraction and time dilation. We act as if no external energy is needed for this. We can simply increase the space-time density by defining the geometry. Unfortunately, that doesn't work either. Space-time has another limit that doesn't allow this. Let's take a look at it.

3.6 Black hole

There is a lower-dimensional limit with the speed of light. Is there also a higher-dimensional limit? One more space-time, not less. The condition for leaving space-time is that time dilation approaches zero. This exists in two places in the universe.

- The speed of light. However, this is the lower-dimensional limit, since one loses one spatial dimension.
- The "singularity" in a black hole. Then, by implication, this must be the higher-dimensional limit.

3.6.1 Higher-dimensional limit

The condition that leads to a black hole must be the higher-dimensional limit. We already know this condition very well. If you pack too much spacetime density (energy) into a length that is too small, you end up with a black hole. We will see that this limit, in combination with Planck's constant, does not allow for an infinite spacetime density in our spacetime.

This condition is known with the specific values. It is the reciprocal of the Planck force. This is somewhat cumbersome to use as a term and in the unit as a force for an explanation. Therefore, we will define this limit differently and choose a more suitable name. We do this as with the space-time density.

Force of sovereign arbitrariness => **dimensional constant** with the abbreviation **d.**

This gives the higher-dimensional limit a clear name. We omit the part "higher" in the dimensional constant. The name speed of light is completely burned into all brains. We can no longer change this. The lower-dimensional limit cannot therefore be meant by the dimensional constant. The dimensional constant, like the speed of light, is one of the most important natural constants in our space-time. This is also a structural element of space-time and not a fixed value.

3.6.2 Definition

The speed of light is defined with $c = \frac{len}{time}$. For the dimensional constant, it is:

$$d = \frac{length}{energy}$$

If you add a length to a force, you get the unit energy. Therefore, for a reciprocal of the force, the fraction in the denominator and in the numerator must be extended by a length. This representation is more suitable for explanations and is therefore used as the definition.

In both cases, it makes sense to have a length in the definition. A density in spacetime always needs a spatial dimension in order to be represented in spacetime at all. Both limits are fractions, since they are each divisions into a length. The length is in the numerator because we need to include a length in time or energy for a density in spacetime to make sense. This will become a general principle. A natural constant for our space-time must always include a length.

3.6.3 Minimum and maximum for space-time

Since the dimensional constant is a fraction again, the same applies here as for the speed of light. The length and the energy do not define a smallest length or a largest energy. It can be half a Planck length and Planck energy again. Only the combination of the values gives the dimensional constant.

The values are known to us again as Planck values. We cannot determine the values purely from the speed of light and the dimensional constant. These are two equations with three unknowns. There is still one piece of information missing. We will obtain the missing information in this chapter.

3.6.4 Resistance of space-time

If you want to give the dimensional constant an analogy, then this is probably a value for a resistance of spacetime to spacetime density. If this value is exceeded, the spacetime density is too high for our spacetime. The spacetime must go into an area that can withstand this value. This can only be a spacetime with one more spatial dimension. A spacetime with n+1 space dimensions is more difficult to deform than a spacetime with n space dimensions. We will need this principle again in Part 3 for QFT.

Our spacetime is already a damn tough piece. Small calculation (Attention! All values for the Planck units are not reduced, so not shortened by 2π):

Planck length = l_P = $4.0513509984905 21 * 10^{-35}$ meter

Planck time = t_P = $1.35138523014162 * 10^{-43}$ seconds

Planck mass = m_P = $5.455511248291575 * 10^{-8}$ kilograms

Planck energy = $m_P * c^2 = 4.903168987059013 * 10^{9}$ joules

$$d = \frac{l_P}{E_P} = 8.262719496683259 * 10^{-45} \text{ 1/newton}$$

$$\frac{1}{d} = 1.210255292342201 \times 10^{44} \text{ reciprocal of d, newton}$$

No matter with which density of space-time we want to cause a curvature of space-time, the curvature of space-time is smaller by this factor. We have to put a lot of energy into a small length so that this value can be bridged. This is the condition that leads to a black hole. Since we know c with the Planck length and Planck time, the only new value that can be added here is the Planck mass. The Planck energy is calculated. Thus these three Planck values determine the boundaries of space-time. Here we have to reverse the definition again. The boundaries of space-time determine these three Planck values and are thus characteristic values for our space-time.

Planck length, time and mass are the characteristic values for our space-time

A black hole is the transition to a higher-dimensional space-time that can represent this space-time density. Conversely, a lower-dimensional space-time must have a smaller Planck mass. These different Planck masses for each space-time configuration will later be the different rest masses of particles in the standard model of particle physics.

Every space-time configuration has its own Planck values for the Planck units

3.6.5 Hierarchy problem

In physics, there is the so-called hierarchy problem. This is a name for the big difference when comparing gravity as a force with the electromagnetic force. We take here as an example the electron as the smallest elementary particle with a charge.

The electrical force between two electrons is: $F = \frac{e^2}{4*\pi*\epsilon_0*r^2}$

The gravitational force between two electrons is: $F = \frac{G*m_e*m_e}{r^2}$

Let's put these two equations in relation to each other: $\frac{\frac{e^2}{4*\pi*\epsilon_0*r^2}}{\frac{G*m_e*m_e}{r^2}}$

This results in $\frac{e^2}{G*{m_e}^2*4*\pi*\epsilon_0}$

If we insert the values, we get: $4.165607*10^{42}$

This is a very big difference when considering it as a force. But we can easily explain that. All basic forces in QFT are always in the low-dimensional. We want to map the entire QFT there later. According to our logic, a low-dimensional spacetime must be much easier to deform than our spacetime. As we can see, the difference in the resistance of the respective spacetime is very large.

We repeat the calculation, but not with the rest mass of an electron m_e, but with the Planck mass m_P. We will pretend that a 2D space-time has the same Planck values as our 3D space-time. Then there is only one difference of 0.001161. This value is known to us as the fine-structure constant α. However, only if we reduce α by $2*\pi$. We will come across this $2*\pi$ again shortly. The forces would then be identical except for α. We will discuss the fine structure constant in Part 3.

The hierarchy problem is simply the large difference in the resistance of space-time configurations when one more or one less space dimension is present.

3.7 G, k and c, d, h

We take a closer look at the natural constants and Planck values used so far. Then we add Planck's constant h, so that we can define our three, as yet unspecified, Planck values of length, time and mass with another equation. Here there is a small anticipation of part 3. We will discuss the Compton wavelength in a moment. We will see that h and the Compton wavelength follow from the low-dimensional boundary of our spacetime and are not directly determined in the low-dimensional (QFT). The GR dictates this behavior to the QFT and not the other way around.

3.7.1 The gravitational constant G

In the textbooks, the three most important natural constants are always c, h and G. In the DP, we will shift this to c, d and h. Then the gravitational constant G must have no further relevance for us. We achieve this because G is composed of c and d. It makes sense that the gravitational constant G is generated from the boundaries of space-time. The behavior of space-time in the classical view with G must lie between the boundaries of space-time. These boundaries are so far the only values determined by our space-time.

Since G is a natural constant, it has not yet been derived. The term “natural constant” simply means that in physics you use a proportionality constant about which you have no knowledge. Not explaining it means calling it a natural constant. We were able to derive c and d as the dimensional boundaries of our space-time. If G is no longer to be a natural constant, we must be able to generate G from known (and, very importantly, derived) natural constants.

Since we are already working with Planck units, we will continue here. The gravitational constant is defined via the Planck units as follows: $G = \frac{{l_P}^2 * c^3}{h}$.

We are anticipating a bit and determining that we can write Planck’s constant $h = l_P * m_P * c$. This gives us $G = \frac{l_P * c^2}{m_P}$. e expand this fraction b c^2. Then we have the desired form:

$$\boldsymbol{G = \frac{l_P}{E_P} * c^4 = d * c^4}$$

The gravitational constant is composed of c and d. We can also explain why c and d have to be used in this way. This means that we have to be able to explain why d is used without exponents and why c has to have the exponent 4.

The dimensional constant d creates a black hole and thus the higher-dimensional limit for the entire spacetime. No matter on which spatial dimension the spacetime density is mapped. If d is reached on any dimension, then the black hole results for the entire spacetime. Therefore, no exponent is needed.

The speed of light c is independent for each spatial dimension. The momentum in one direction does not affect the other spatial dimensions. Length contraction only occurs in the direction of motion. Therefore, a c^4 must be used to consider the entire spacetime. But, the time dimension always goes with a space dimension. Why not a 3 as the exponent? This comes from the structure of the field equations for GR. We will show this in the next section.

3.7.2 Proportionality constant k in GR

Let’s take another look at the field equation of GR: $G_{\mu\nu} = k * T_{\mu\nu}$

The tensors G and T contain the structure of space-time with the respective metric, as the solution of the equations. The proportionality constant k is metric-independent and should therefore not have to take into account the structure of space-time. Only the boundary condition should be included. This is not dependent on the metric. And that is exactly how it is. The normal description of k is constructed as follow:

$$\boldsymbol{k = \frac{8 * \pi * G}{c^4}}$$

We now use our new definition for G and get:

$$\boldsymbol{k = \frac{8 * \pi * d * c^4}{c^4} = 8 * \pi * d}$$

We immediately recognize that G is not needed in the field equations. You have to explicitly divide k by the c^4 so that you can use a G there. In the metric, we treat the time dimension as a space dimension. The different dimensions exhibit a dependent behavior as space dimensions only in the metric. G does not recognize this mutual behavior. Therefore, in this description, th c^4 in G also makes sense. Each dimension is separate

If we eliminate G, then the boundaries of space-time must nevertheless appear in the field equation. The energy-momentum tensor T describes the different forms of energy. Since a c is always necessary to describe the energy, the lower-dimensional boundary is included in T. The higher-dimensional boundary is a resistance value of space-time independent of the distribution of the space-time density in T. Therefore, we can extract this from T and there may be a k. k must then only contain the higher-dimensional boundary. Thus, k is constructed to fit our logic. The space-time density generates space-time curvature against the resistance of space-time.

Where does this 8π come from? If you set up the field equations mathematically, it is absolutely clear where the 8π comes from. But we want to have a reason for everything. Unfortunately, in 2025, I still haven't found a reason for this. It is clear that this lowers the resistance of space-time. So here we are doing something for the first time. A guess and a challenge.

- Invitation: Everyone is allowed to think about why the resistance has to be lowered. I am curious about the answers.
- Guess: The 8π are 4 * 2π. For each space dimension a 2π. There is a length in d. The circumference is 2πr. Then the resistance would not be mapped onto a straight line, but onto a circle. Since the circumference of the circle is larger by 2π than a simple length, this would fit. The space-time density for the resistance must react on a curvature and not on a flat space-time in the space-time curvature. These are also the missing 2π from the classical force comparison. But I'm not sure about this. The why is not yet 100% clear here.

We have done enough on the good old G. Let's look further and move on to the feat that h can be derived from the continuous and non-quantized GR.

3.7.3 Planck's constant h

Let's complete our trio of explainable natural constants. The h is still missing. Do we need the h at all? We were able to generate a G from c and d. We know the value of G. Then we have three equations with three unknowns. We can use this to determine the Planck values. From a purely mathematical point of view, this works. From a physical point of view, however, we do not obtain any new information about space-time from G. The gravitational constant is only a composition of known things. We need an additional condition from the space-time boundary.

As the name suggests, h is an action quantum. Let's first turn off the "quantum" part and focus on the "action". Action means a change. From one fixed state to another fixed state. The action describes a change of state. The state that we can recognize is always some form of energy, i.e. space-time density. It is about the change of state of the space-time density.The higher-dimensional boundary arises from the description of the GR with the curvature of space-time. However, the "quantum" part is certainly not included in this. No one has yet succeeded in quantizing space-time curvature. So let's look at the combination of space-time density and low-dimensional boundary. This topic will be part 3 and the description of the entire QFT. Here we only consider the direct transition into our space-time.

The GR describes the behavior **in our** space-time with the boundaries, but not outside of space-time

3.7.3.1 Definition von h

We want a description of an effect from the low-dimensional boundary into our space-time. What do we start with? Exactly, a length. In DP, we only have the space-time density and thus everything must map onto one space dimension. We always need a length.

Step 1: $h = l_P$

Since we want to have an effect from the low-dimensional space, the boundary condition must be fulfilled. We need the speed of light exactly once. Here, however, multiplicatively and not as a fraction. We want to produce an effect. We can only reach this limit once in our spacetime. The time dimension is already zero when there is a single missing spatial dimension. Therefore, c must not have an exponent.

Step 2: $h = l_P * c$

Then we still need something with which we want to act on the space dimension. We don't have much choice in DP. It has to be a form of space-time density. Only direct energy, so it can't be the space-time density in our space-time. We are anticipating a later section here. No time passes over this boundary, since the time dimension is always bound to the respective space-time configuration. Let's look at the definition of energy again.

$$\boldsymbol{E = \sqrt{m^2c^4 + p^2c^2}}$$

The second term cannot be it. Momentum is the increase of a given spacetime density in one direction. It is precisely this part of spacetime density in our spacetime that we do not have. If we move within our spacetime, we will not get very far in describing the boundary. So, the first term. But there is still a c present. The c is the crossing of this boundary and is already included in step 2. We have to use the energy without c. This actually already clarifies what mass is. A mapping of a spacetime density from an n-dimensional spacetime into an (n+1) dimensional spacetime. Therefore, it is not surprising why the spacetime boundaries always play a role when describing the energy of a mass. However, we will do this more precisely in a later chapter. What is important here is that we can only use the rest mass.

Step 3: $\boldsymbol{h = l_P * m_P * c}$

Done! The effect from a lower-dimensional space-time into our space-time may only look like this. Ok, but what about the "quantum" part? It could be a mapping on an arbitrary length, a different velocity or a different mass. Why the Planck values of our space-time, if the effect comes from the lower-dimensional one? In particular, we said before that in the lower-dimensional space-time the Planck masses are explicitly different from those in our space-time.

3.7.3.2 Quantization

The limits come from the GR. This only describes one spacetime, our spacetime. When we measure something through an interaction or obtain information, this only and exclusively happens in our spacetime. Energy is the spacetime density of our spacetime. We are still at the stage where we can only recognize the spacetime density and curvature of our spacetime.

This means that any effect on a space-time density is a change in the space-time density in our space-time. Thus, this effect must adhere to the conditions of our space-time. This is h between the boundaries c and d with the known Planck values. That is the structure of our space-time. As stupid as this sentence may sound: the quantization of all effects does not come from QFT, but only from the limits of our continuous space-time.

The quantization by h arises from the characteristic Planck values of our space-time

To make this thing round, we go to the next section and look at another "QFT object", the Compton wavelength.

3.7.4 The Compton Wavelength

Why do we include the Compton wavelength here? Isn't it a prime example of QFT? Because we need a state in addition to an effect. Unfortunately, this fact is well hidden in the textbook descriptions.

The designation is often the Compton effect or Compton scattering. A photon is shot at a particle with rest mass. That sounds very much like a process and not a state.

The appropriate formula : $\Delta\lambda = \frac{h}{m_C * c}(1 - cos\varphi)$.

The formula describes the increase in the wavelength of the photon due to the scattering. What is striking is that the photon is not included in the formula. Only the angle is important. Let's make life easy for ourselves and assume an angle of 90° for the scattering. Then the cosine is zero. The formula simplifies and we get a characteristic wavelength for a mass, the Compton wavelength:

$$\lambda_C = \frac{h}{m_C * c}.$$

This looks a lot simpler. The superscript capital C denotes the particles involved in the scattering. The equation still contains an h. This is a poor representation. The formula describes the result after the process and is therefore a description of a state.

Let's take our new definition of h and insert it into the formula:

$$\lambda_C = \frac{h}{m_C * c} = \frac{l_P * m_P * c}{m_C * c} = \frac{l_P * m_P}{m_C} \Rightarrow \lambda_C * m_C = l_P * m_P$$

To make it look a bit nicer, we rename λ_C to l_C.

$$\boldsymbol{l_C * m_C = l_P * m_P}$$

This is a good result. Let's take a look at what this formula says:

- The Compton wavelength is a description of a state after scattering and not a description of a process. There must be no h on the right side. Therefore, the c for the speed of light must be removed from the formula. The c is the transition during the effect. The c is not needed for a state in our space-time.
- On the right side, you can see the h without c ($h = l_P * m_P * c$). This formula must be valid for every object with rest mass in our space-time. It follows that there is only one unique state in our space-time. In our space-time, only $\boldsymbol{l_P * m_P}$ is allowed as a state for objects with rest mass.
- The "internal" structure of an object (QFT) can be divided differently into $\boldsymbol{l_C * m_C}$. Our continuous space-time has no condition for quantization. This only comes from the boundaries. Since the effect is always tied to a h, only states in this step size come about. Our continuous space-time does not explicitly specify this. This only comes from the transition of the boundary condition.

Anyone who was surprised that we can create a quantization from the GR will have to bite the bullet now. We're going to up the ante. Take a deep breath and let's go.

- In our space-time, due to the boundaries of space-time, not only are all effects quantized, but there is also only a single recognizable state for a single space-time density with rest mass $\boldsymbol{l_P * m_P}$.

- The QFT describes all possible “internal” mappings in lower-dimensional spacetimes of this spacetime density and possible interactions between these lower-dimensional mappings in our spacetime. These lower-dimensional spacetimes (fields of the QFT) themselves are also not quantized.
- No single space-time knows a quantization by itself. Only the dimensional transition between space-times with different numbers of space dimensions produces a quantized effect and a single recognizable state per space-time.

The state of a single space-time density is fixed with $\boldsymbol{l_P} * \boldsymbol{m_P}$. The change with an h is only a different division on the side with the inner structure $\boldsymbol{l_C} * \boldsymbol{m_C}$. This is the reason why h is added to the QFT. However, the definition comes from the boundary of our space-time.

That was a bit much, but two important properties from the boundary of space-time are still missing.

3.8 Recognizable geometries across a dimensional boundary

In the previous logic, it is not 100% clear why we can recognize interface objects in our space-time. The following question arises. Which properties can we recognize across a dimensional boundary? We are sure that we must be able to recognize something. In our space-time, there are photons as objects for the lower-dimensional boundary and black holes as objects for the higher-dimensional boundary.

We will see that we can only obtain very few properties across the dimensional boundary. This will go against normal intuition. There are two broad areas. Time, which we will discuss in the next section 3.9. Here we are concerned with the geometry of objects and thus with the geometry of spacetime.

3.8.1 Higher-dimensional boundary

That a black hole is supposed to be some form of transition is old hat. There are lots of different ideas about this. One of them, for example, is the keyword: wormhole. If you don’t look at it too strictly, then a higher-dimensional transition only looks like a wormhole. In the DP into a higher-dimensional space. With the ingredients black hole and transition, it is very easy to come up with this idea. Unfortunately, the wormhole does not fit. To get to the point, the idea of a wormhole is completely wrong.

3.8.1.1 Übergang per Dichte oder Krümmung

The problem is graphics of this kind

Figure 18

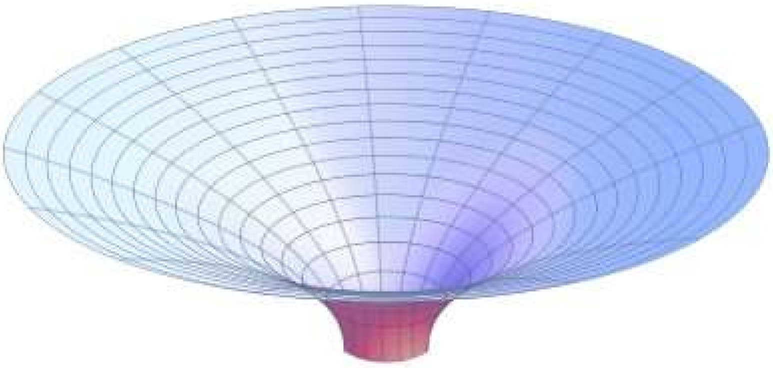


Figure 18 shows the Flamian paraboloid.

source reference: Wikipedia 2025 Mrmw – My own work, based on: Lorentzian Wormhole.svg

A spacetime curvature from our 3D spacetime is traced back to a figure in a 2D spacetime. Mathematically, everything is clean with one restriction. The GR does not need a higher-dimensional surrounding space for the spacetime curvature. The figure shows the 2D spacetime curvature explicitly with an extrinsic expression in 3D. According to GR, this is wrong. But there is no other way to represent it. Such a picture of space-time as a funnel is called a wormhole. The "bottom" of the funnel is crucial. Where does the "hole" go? This is precisely where the problem lies. There is no hole.

The image of the funnel leads one to think that a wormhole is created by the curvature of space-time. That is also the general textbook opinion in physics. Here from the DP a clear, no! The space-time curvature has nothing, but nothing at all to do with the transition. The funnel image leads us on the wrong path. The condition for the transition is:

$d = \frac{l_P}{E_P}$. It says something about length and space-time density. There is no space-time curvature.

Space-time curvature is the equalization of space-time to form space-time density. But the transition is the space-time density and not the space-time curvature. Ok, the transition lies at the bottom of the funnel and the space-time curvature leads there. But the space-time curvature is not the transition. There is no singularity of space-time curvature. The bottom must simply be a flat disk in this representation. Space-time curvature only goes as far as space-time density. Thus, the bottom is flat. Exactly this flat bottom without space-time curvature must be connected to a higher space-time.

Space-time density, not space-time curvature, is the reason for the higher-dimensional transition

Countercheck: If the transition lies in the curvature of space-time, then there should be a maximum value or a singularity for the curvature of space-time. At the singularity, we have an infinite value, which cannot be a transition. If we have a maximum value, then the growth of a black hole should be limited. The curvature of space-time then only reaches this value. No more matter could fall into the black hole. A growth limit for a black hole is not known.

3.8.1.2 4D to 3D

What can we recognize from a space-time density that also lies in 4D? These can only be the properties of our space-time that are connected by the transition. This is not much in the case of the space-time density. We only recognize the properties of energy. Let's get the formula for the energy again:

$$\boldsymbol{E = \sqrt{m^2c^4 + p^2c^2}}$$

The first term is then the rest mass of the black hole. The second term is the motion of the black hole in our space-time. There is the momentum and the angular momentum. That's it, we don't have more.

3.8.1.3 Information paradox

Wait a minute! We know our way around this topic. A black hole has at least the property of electric charge in addition to its mass and proper motion. The charges must not simply disappear. This leads us directly to the information paradox of a black hole.

The first limitation on the content of a black hole comes from the curvature of space-time. We agree with QFT that all interactions of the standard model without gravity can only be transmitted via exchange particles. The fastest of these is the photon. A black hole is characterized precisely by the fact that even a photon cannot leave the event horizon. Thus, not a single property of QFT can be known outside the event horizon.

It is a mathematical theorem in QFT that no information can simply disappear. Since we do not change the mathematics of QFT, but confirm it, we have to stick to this theorem. The fact that we humans outside the black hole can no longer access this information is not the paradox, but only our own arrogance. This is not important.

The problem lies in Hawking radiation. The exact mechanism is not relevant here. What is important is that a black hole can release its energy as radiation. However, the photons from the edge of the event horizon do not carry any information about the electric charge. But Hawking radiation consists only of photons. So where did this information go?

The information is indeed no longer present on the “bottom” of the funnel. Nevertheless, we do not violate the information theorem. You can probably already guess the reason. The dimensional transition. The low-dimensional transition between 3D and 2D generates the entire QFT. Only in the center of a black hole are we at the transition from 3D to 4D.

The condition for a black hole is: $d = \frac{l_P}{E_P}$

The condition for a mapping across the low-dimensional boundary is:

Effect $h = l_P * m_P * c$

State $l_C * m_C = l_P * m_P$

The condition in d is explicitly such that we either have a length smaller than l_P or energy with a mass greater than m_P. Then we cannot map either an effect or a state in our spacetime via the low-dimensional interface

This makes perfect sense. The QFT is derived from the 2D to 3D interface. In the black hole, however, we are out of the space-time and exactly on the boundary to 4D. There is no longer a 2D mapping. With the formation of a black hole, the 3D space-time density loses its 2D mapping for the QFT. The QFT is no longer responsible there and cannot make any statement about the higher-dimensional transition. There is no information paradox from the QFT in a black hole. The QFT loses its validity at the center of a black hole. There is actually no longer a low-dimensional “inner” structure of the space-time density. Thus no information. It is even the other way around. If Hawking radiation could be something other than a photon, then we would have a problem.

Maybe you can guess from here on how I feel when, over and over again, the great promise comes that only QFT with a quantum gravity can solve the mystery of the singularity in a black hole, **lol**.

3.8.2 Low-dimensional limit

The exact description of the interface is the entire part 3 QFT. Here we only discuss one point. If everything is a deformation of spacetime by density and curvature, why can’t we recognize this geometry directly from the low-dimensional one? We are not saying that an elementary particle has a spacetime curvature. New labels such as spin and charge are added. This suggests that it is not so easy to recognize a spacetime geometry across a dimensional transition.

The whole thing is even wilder. You can’t even recognize any geometry at all across such a boundary in a first approach. This almost marked the end of the DP. It was clear that this transition would be one of the most important properties of the DP. But for a very long time I couldn’t find a geometric mapping across the boundary. In retrospect, the solution was so simple and obvious that I was really ashamed of it. Once the solution is there, everything is very simple. But you have to come up with it first. The solution is the interface itself. From this point on, almost all further problems solved themselves. All that was needed then was a little time and brainpower.

3.8.2.1 No more

The real problem is not a low-dimensional transition, but basically the transition with a different number of spatial dimensions.

We start simple and imagine a volume. Length * width * height. In our space-time, the volume has an extent and a surface. That's all clear so far. Now we take a surface with length * width and height = 0. One space dimension must be zero. That's the definition of low-dimensional. Then, by definition, the volume and surface area are also zero.

But we can still specify length, width and area for the surface. These are dimensions, aren't they? Yes, but that's another mathematical abstraction, similar to the discussion with the point, this time in 2D. In 3D, we cannot recognize the beginning or the end of length or width. The height is zero. For us as 3D beings, there is nothing. A 2D surface can be described in a mathematically abstract way, but it cannot be recognized in real 3D space-time. It doesn't get any better if we turn the surface into a sphere (a closed object). Because the height or thickness of the surface that limits the sphere is by definition zero. There is nothing there.

Everyone has to think about this for themselves in a quiet moment. You will come to the following conclusion:

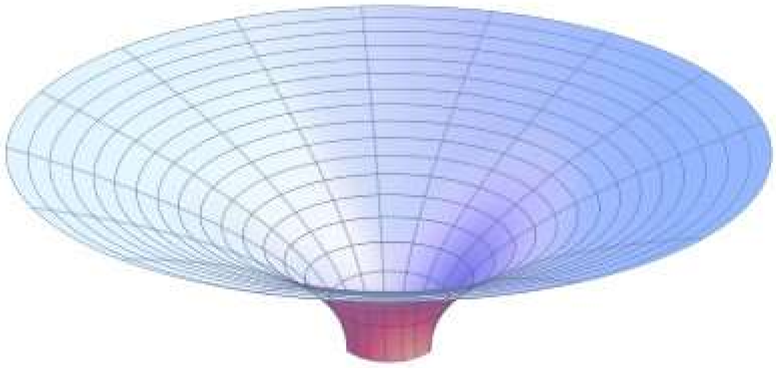
No geometric quantity can be passed across the dimensional boundary

Length, volume, surface area or even a distance are only meaningful geometric quantities within one's own n-dimensional spacetime. It does not matter what form the lower- or higher-dimensional geometry has. In one's own spacetime, this geometry is not recognizable. That's damn little. We will see in Part 3 that it is precisely this behavior and the lack of time from Section 3.9 that make the description of QFT so "strange.".

We should be able to recognize something, otherwise our approach is wrong. It is not necessary to be able to recognize geometric form. We must recognize spacetime density. Everything is based on that.

3.8.2.2 The problem is the solution: extrinsic expression

In the textbook description of GR, spacetime curvature and thus also spacetime density are always intrinsic to spacetime. Let's get our funnel image, Figure 18.



This means that the spacetime curvature must lie in the plane. In the funnel, however, the spacetime curvature is explicitly drawn downwards out of the plane. This makes it an extrinsic representation and actually incorrect for the GR. Really? Why does one not want to have an extrinsic representation in the GR? This is exactly where the solution lies.

Then our 3D spacetime would have to be embedded in a higher-dimensional spacetime. Since you want to make do with as few additional assumptions as possible, you omit this and make the mappings intrinsic. This is mathematically not a problem. However, the description of GR could just as well be done extrinsically. This is the application of Occam's razor.

Fortunately, we are in the description of DP. The spacetime boundaries imply that the low-dimensional spacetimes are embedded in our spacetime. Our spacetime is then embedded in at least one higher-dimensional spacetime because we have black holes. The spacetime boundaries exist. It follows for us that we can use an extrinsic description without restriction. In part 3, we will see that we can only recognize extrinsic properties, with one exception: rest mass.

Here is a false image of a 2D surface in a 3D volume. There can be as much 2D geometry as you like in the 2D surface. We can't see anything. The surface is just an abstraction.

Figure 19

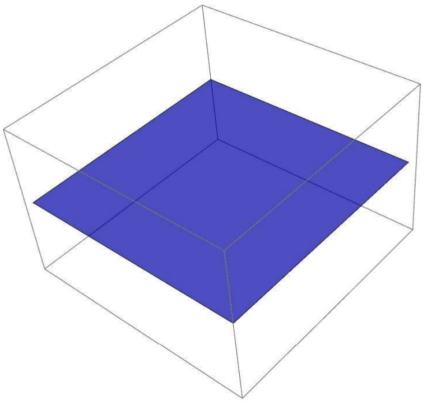


Figure 20

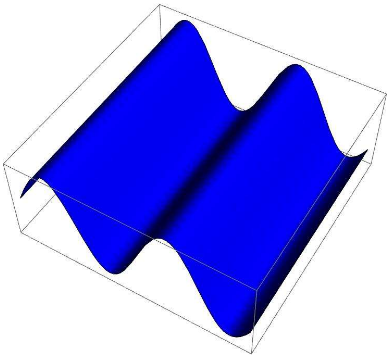


Figure 19 shows a simple surface. If it were truly 2D, we would not be able to see it. Figure 20 shows a wave. In a 3D volume of space-time, there are more 2D volumes of space-time in the wave.

But if we extrinsically warp the 2D surface into a wave, then the 3D volume contains more 2D spacetime. This is an increase in spacetime density in the 3D volume. That is, more low-dimensional spacetime is contained. This means that if we break away from the default of not using extrinsic deformation, then we have found a possibility for a recognizable space-time density.

The dimensional interface, which does not pass any geometric properties, but also due to the embedding, means that we can use an extrinsic deformation. We can recognize this expression in 3D. A pure wave representation cannot be recognized in 2D. It must always be via the space-time density. We still need something to combine it, but we will discuss that in part 3. For now, we have found a possible transition for mapping space-time density in 3D.

3.8.2.3 The problem is the solution: black hole

Wave mapping sounds like it's going in the right direction for QFT. For QFT, we have to map the entire particle zoo of the Standard Model in low-dimensional space-time configurations. The possibility of extrinsic mapping is a start. However, this is never enough for the variety needed. It's nice to know that something is still missing. But what is it? We have already looked at the solution twice and discussed it.

Drum roll, the solution is: the funnel. I'm leaving out the picture here, otherwise it wouldn't have been a surprise. About the funnel in connection with the space-time boundaries, we came up with the idea that we can use an extrinsic mapping like the funnel. Question: Which object should the funnel map? Exactly, a black hole. What is a black hole? Right, the higher-dimensional transition. We need a mapping of a black hole in the lower-dimensional space. Then we have a higher-dimensional transition from 2D to 3D and are exactly where we want to be, in our space-time. It's just stated here in the paragraph. Believe me, this simple idea was a difficult birth.

This black hole is also the reason for particles with rest mass. It is funny that there is a small calculation about a black hole in quite a few textbooks. Please calculate why an electron cannot be a black hole. The calculation is simple and results in a Schwarzschild radius of approximately $1.353 * 10^{-57}$. This is smaller than the Planck length. Thus, an electron cannot be a black hole. We will see later that this statement is absolutely correct for our spacetime. There is a minimal limit for the Schwarzschild radius. The electron is many orders of magnitude below that. But the electron is the perfect black hole in a 2D space-time. With a much smaller dimensional constant than in this space-time. Every space-time has its own Planck values. We already know the Planck mass of a simple 2D space-time, the rest mass of the electron

3.9 Time

The mystery of time certainly deserves more than just one section in this chapter. We can be sure that we will not solve this completely here either. We need a suitable logical description of time for the DP. This is discussed here because in the DP, time is only understandable in the context of the space-time boundary.

Time is always associated with a change. Without a change, no time could be recognized and vice versa. In the DP, everything we can recognize is associated with at least one spatial dimension. To map a density, we need at least one spatial dimension. A change in a mapping is therefore always a change in spatial dimension and time. Time and space are therefore not independent.

We have already started with an approach from the GR. Therefore, it is clear that we have to work with space-time as an inseparable object. However, it still makes sense to derive this unit as a consequence of density on the spatial dimension. Since space and time are not independent, we stick with space-time and space-time density.

But the question remains why time does not simply pass at a constant rate when the space density changes. This is because the change in the density of space is a change in the definition of space. Velocity is length divided by time. Time remains the same, but the length becomes "shorter" when accelerating. The object would slow down when accelerating. This does not correspond to observation. The calculations of GR only work because the time dimension has been made into a space dimension. Again: the time dimension in GR is the same as in SR, a space dimension with different signs. With the space dimension, the definition of geometry changes. Thus, the time dimension must also change as the definition of time. Space and time dimensions change the definition of what a unit of length or a unit of time is. Nothing is squeezed or stretched.

Time is therefore bound to the space-time configuration. If this configuration changes, for example one dimension of space less, then this is no longer the identical space-time. The object space-time is left. Then time must also run towards zero. Therefore, each space-time configuration must have its own time dimension.

From this we can derive the following things for ourselves:

- The time of a space-time cannot continue across the dimensional boundary
- Each separately existing space-time configuration has its own time dimension that is bound only to that space-time. The time dimension is not only dynamic, it is also local to each space-time. Therefore, we do not count the time dimension when counting the number of space dimensions. There is always an additional time dimension. We also only count one head on a person, and not one person and one head. It is always there
- The dimensional transition only applies to the spatial dimensions, but never to the time dimension

From the point of view of time, the space-time boundaries have been reached when it is no longer possible to achieve any effect on a state, no more change. Then you can no longer determine time. Let's look again at the small formulas for effect and state in our space-time:

Efffect $h = l_P * m_P * c$

State $l_C * m_C = l_P * m_P$

Let's take only the right side in each case and put the effect in relation to the state:

$$\frac{state}{effect} = \frac{l_P * m_P}{l_P * m_P * c} = \frac{1}{c}$$

This is the "resistance value" of space-time to change. This is bridged at c and there can be no more change. The effect from the low-dimensional must still be able to change the state mapping from the low-dimensional. This is the low-dimensional boundary.

From these considerations, we can equate time with the distance to the boundaries of space-time.

Time is a distance measure to the space-time boundary

Thus, in DP there is no flow of time or time arrow. The better way of looking at it is that experiencing time is the constant measurement of the distance to the space-time boundary. Therefore, there is no past. The next measurement at the boundary is always coming. The "measured value (the definition of the time unit)" can repeat itself from the past. But it is a different measurement. The flow of time is the series of distance measurementsn.

Finally, an often-asked question: Why is there only one time dimension? This question can be easily explained with our new perspective. You can leave the object space-time exactly once. Then you're out. We can't leave space-time again once we're out. Therefore, there can only be one time dimension. The passage of time is the distance measurement to the space-time boundary. There is only one time dimension per space-time possible.

The idea that time is a measure of distance has another reason: the principle of relativity. This is a very good way of explaining a locally constant time. This will be worked through in the next chapter.

4 Principle of Relativity

The SR is based on only two principles

- Relativity
- Speed of light

That sounds very simple. It is. Nevertheless, we will have to look at things here contrary to the textbook approach. With the DP, we have shifted an important aspect for the principle of relativity. It appears that a spacetime density and thus also the state of motion have an “absolute” value. We will see that this is not the case. However, there is information of smaller and larger between motion states. According to the textbook approach of the principle of relativity, this is not allowed. Every object can be considered at rest and there must be no smaller or larger. Even the word “motion state” is not correct there. This always depends on the chosen reference system. You cannot clearly assign a state to an object in motion. But that’s exactly what we’re going to do. To top it all off, we will necessarily create the principle of relativity for everything that exists in the universe from it. Sounds exciting, doesn’t it?

The counterargument of the Lorentz ether theory always comes up. It is important to note that we never use an ether. There is only spacetime. An additional ether in any form is explicitly prohibited by the DP. A suitable idea from the DP is that spacetime and the ether are a single identity.

We have already shown in the previous chapter that the speed of light is the maximum speed. But that is not enough. It must also be shown why this limit is locally identical for every observer. If there is a smaller and a larger limit, then we can determine who is closer to the space-time limit, right? No, we can’t. This has nothing to do with the fact that the speed of light is defined identically for all observers. Once again, this is because all deformations of space-time are a change in the definition of geometry.

4.1 History of the development of the SR

We are taking the classic route here. We start with Galileo and move on to Newton, Maxwell and Lorentz to Einstein. We will then see that Einstein did everything right by combining the speed of light and the principle of relativity, but also allowed himself a great deal of fun. This is often not recognized. But it is essential for us. Therefore, we will look at the sequence of developments in more detail. I realize that this section can be a bit tedious for the “initiated”. Please read it anyway. I am curious to see if you were already aware of this insight. Most people overlook it and jump straight to the calculations. But then you have not discovered the fun part of the SR.

4.1.1 Galileo

Galileo is often regarded as the father of modern physics. For us, Galileo introduced the most important thought experiment into physics, the locked box. We need it in the SR without and in the GR with interaction. That was Galileo’s basic idea of the relativity principle. For him, the locked box was a ship’s cabin without the possibility of seeing outside. The whole thing on a very calm flowing water. In Einstein’s later work, it was a lift or a spaceship. Everyone is a child of their time.

If we are sitting in such a ship’s cabin, we cannot determine whether we are moving with the water or standing still. A reference system or point is missing to determine the movement. From this it is deduced that movement can only be determined relative to a reference point. We extend the thought experiment with two boxes that only have a small viewing slit. Nothing other than the boxes themselves cannot be seen.

Figure 21

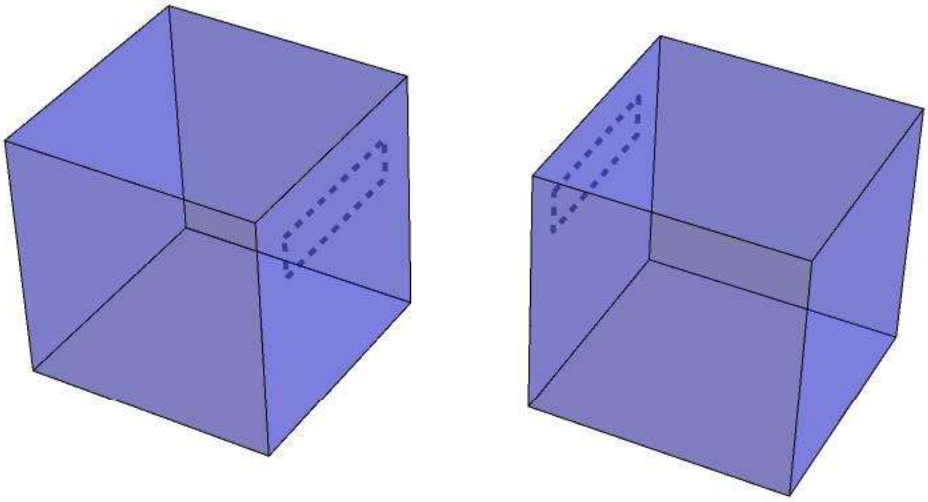


Figure 21 shows two closed boxes with a "peephole". There is no other reference point.

If we sit in a box and look out, we can see the other box passing by our box at a constant speed. If we cannot feel any acceleration, then we cannot determine for ourselves whether we are moving and the other is at rest or vice versa. It could also be that both boxes are moving at different speeds and no one is at rest. The only recognizable quantity is the difference in motion between the two boxes. We can only determine the relative motion of the boxes to each other. Both boxes could also move in the same direction at the same speed, in which case we would not detect any motion between the boxes. This is the result of the relativity principle.

A transformation is always part of a relativity principle. This is the change of perspective from one box to the other. This is called the Galileo transformation.

4.1.2 Newton

The principle of relativity is so simple and logically clear that Newton used it as the basis for his description of physics. Newton coined the term 'inertial system' here. This is not subject to acceleration and is therefore at rest or in a uniform and straight motion. This means that every inertial system is suitable as a reference system for determining relative motion. In particular, Newton's axioms only apply in an inertial system. The crucial thing for us about Newton's statement is that an inertial system can be at rest **or** in a rectilinear uniform motion. These are indistinguishable.

4.1.3 Maxwell

After Newton, the world was in order for about 200 years. Until James Clerk Maxwell came along. He achieved a similar feat to Newton. Newton combined all the individual loose ideas into classical mechanics in a single, almost completely consistent theory. Maxwell did the same with the individual parts of the description of electricity and magnetism, and with electrodynamics he also delivered an almost completely consistent theory. However, this has given rise to a problem that we are familiar with. The two major theories, which were supposed to describe all of physics at the time, did not fit together in some places. Somehow, over time, the problems keep repeating themselves. We will pick out two important points.

1. The description of magnetic and electrical effects in relation to each other is not compatible with the Galileo transformation in certain situations. We need a different description for each chosen reference system. However, physics should not make any distinction between the reference systems. In all inertial systems, the laws and formulas of physics should be identical.
2. According to Maxwell, we can determine the speed of light with the following formula:

$$c = \sqrt{\frac{1}{\epsilon_0 * \mu_0}}$$

The problem with the description is that ϵ0ϵ0 is the electric field constant and μ0μ0 is the magnetic field constant, both of which are unchangeable natural constants. This is independent of the state of motion. Then c must also be an unchangeable natural constant. The speed of light must always be the same, regardless of the reference system. All natural constants must be identical in every reference system. These reference systems were still inertial systems. This allowed them to move in a uniform and rectilinear manner. How can the speed of light remain the same if it is observed from an already moving inertial system?

4.1.4 Lorentz

At that time, Newton was the demigod of physics. Therefore, a solution was sought that had to match Newton’s description. The solution was the ether. It was already known that light is an electromagnetic wave. So this wave description had to have a medium. Like waves in water or sound in air. This medium for the propagation and excitation of electromagnetic waves is said to be the ether. Thus, the speed of light has this absolute and fixed value of speed only with respect to the ether. Galileo’s principle of relativity would thus be saved.

It was recognized early on that this ether must have very strange properties for all this to work. In addition, this ether could not be detected in any experiment. In particular, the experiment by Michelson and Morley in 1881 and 1887 caused a great deal of trouble for an ether theory. The purpose of the experiment was to find an ether by observing the movement of the earth through the ether. The result was negative and has remained so to this day.

Lorentz then came to the rescue of the ether for this experiment. A new transformation was developed, the Lorentz transformation. This is constructed in such a way that the existence of an ether is compatible with the Michelson-Morley experiment. However, for this to be the case, a length had to be shorter and time had to be slower in the direction of motion. Length contraction and time dilation were already known as mathematical facts before the SR. For Lorentz, length contraction only existed in the electromagnetic field (ether) and time dilation was a pure mathematical tool.

Purely mathematically, Lorentz had found a solution. Now comes the joke. This has been developed for an ether theory. This means that the Lorentz transformation only works with an absolute zero point and the associated absolute speed. That should be clear. If an absolute speed is assumed, then there must be an absolute zero point. Here, everything is in relation to an ether.

4.1.5 Einstein

But now finally to our joker. Einstein made the following assumptions when developing the ST, in my opinion:

- Maxwell is right and not Newton! The speed of light is the same absolute value for all observers.

- If the Lorentz transformation solves the problem mathematically, then it must be the appropriate model.
- The principle of relativity must be correct for all of physics. Maxwell's equations should not change depending on the reference system.
- Since no ether has been found, there is none

These points are sufficient to arrive at the SR. We can use them to build the following logic:

- There is no ether.
- This means that relative motion is directly in space
- All conditions for a relativity principle must lie directly in space.
- If length contraction and time dilation are required from the Lorentz transformation for an absolute speed of light, then this must be mapped directly onto space and time.
- Since length contraction and time dilation are not independent of each other, space and time must be regarded as spacetime.

This almost gives you the SR. For a proper justification of the length contraction and time dilation of space-time, which was a very bold assumption at Einstein's time, Einstein argued a lot with the simultaneity in space-time. Or rather, with the no longer existing simultaneity. To do that, he had to make an additional assumption that was not there before. The speed of light is not only constant, but also maximal. According to Maxwell, c is simply constant for electromagnetic waves. For Einstein, this now had to be the maximum for any effect in space-time. Only with this extension does SR result. Therefore, this condition looks like a "foreign body" in the theory for many.

Due to the maximum speed, there can no longer be simultaneity for an effect from one point in space-time to another. The effect always requires time between the space-time points. If there is a length contraction and a time dilation between these space-time points, this becomes more and more visible. We will soon set up a different approach that is better suited to DP and avoids the discussion of simultaneity for length contraction and time dilation.

Ok, so much for the historical digression. What's the joke now?

4.2 Basis of the ST for DP

If we follow this logic, then, in my opinion, we do not see the joke of it. The same applies to the argument with simultaneity, which we will not pursue further here. But that is exactly how it is explained in the textbooks. That is why almost no one notices. Einstein did not just change Galileo's old principle of relativity. He built a completely different principle of relativity. The basic assumptions of the Galileo transformation and the Lorentz transformation are mutually exclusive.

No problem, then Einstein is right and Galileo is not. Unfortunately, this is not so easy in DP. We will build a third concept as an argument for a principle of relativity. This follows more the assumptions of Galileo and Newton. However, Einstein must also be right, although the approaches are mutually exclusive. The SR has been flawless in all calculations of the experiments for 120 years. It cannot be wrong. The different approaches to relativity must be mathematically identical under certain circumstances. This feat is only possible because all deformations of space-time are a change in the definition of space-time geometry.

4.2.1 Measurement

Let’s ask a simple question again: Why is there a principle of relativity? We had already discussed this with the boxes. It’s so simple, why even discuss it? If you don’t understand this, you don’t need to bother with the SR. That’s exactly the problem. Everyone understands the logic with the boxes. The mathematics for this is simple and we’ll start with the calculations. That’s why the fundamental question is never asked. Now I’m going to make a bold statement. When we look at different textbooks on the SR, it is clear to me that almost no one has understood the actual idea behind the principle of relativity.

Let’s address the fundamental question. The approach comes from the example with the boxes. A relativity principle only arises if we can only determine differences between objects (boxes). We expand this statement in a very general way. This is not only the case at speeds. This is a general problem of measurement. We move away from speed and do this for length. Then the examples become a bit simpler.

We can make a measurement if we have at least two measuring points. With a length, this is clear to us. With one measuring point, we cannot determine a length. But neither can we determine a speed or an electrical charge. The second measuring point is just not always immediately clear to us. The other measuring point is often the zero point. However, this can also be a maximum value. It does not matter whether we take a measurement at a maximum or minimum value. To specify a value, we always need two measuring points. A measurement is a comparison. For us, this was the two boxes. Then we can measure a difference.

We want to give an absolute value. This is a value that must not change for any observer. Then we need an identical measuring point for all observers. Intuitively, we always equate this with the origin. This means that as soon as we can define a general reference point for the measurement that is common to all observers, a relativity principle is no longer possible. This is important for the ST. We may agree on the measured value of a difference. We call this an invariant quantity. However, the measuring points that led to this invariant quantity must not be “invariant” themselves. These must then be explicitly different, otherwise we do not get a relativity principle.

The fundamental question now formulated differently: When can we only determine a difference? To put it bluntly, when we have lost our zero point. It is not possible for us to give an absolute value if we cannot give a generally valid reference point. Then a relativity principle is inevitable. The only information that can be given are differences. With this idea in mind, we will go through our variants again (and I promise, this is the last time). After that, we will build the new idea for the relativity principle for the DP.

4.2.2 Relativity with Galileo transformation

Newton and Galileo agreed on the principle of relativity. We stick with good old Newton. Based on the definition of his axioms, we see Newton’s view as the best for the Galileo transformation. An inertial system is either at rest or in a rectilinear uniform motion.

Both states of motion are explicitly mentioned there, and in particular, rest is listed separately. This means that we have a point of origin and there can be no principle of relativity. What is the error in reasoning here? The word “or” is not simply a list. This “or” is to be understood in such a way that the two states of rest and rectilinear uniform motion are indistinguishable. It can be one or the other, since we cannot distinguish the states of motion. That was the approach with the boxes. We cannot determine whether we are moving or not. This means that we cannot determine one thing, the zero point. A relativity principle follows.

A minimum value is not given. What about a maximum value? The two probably agreed on that too. In their time, no one thought about a maximum value for a speed. This means that there is no general reference point.

If we take this as an image, this is what emerges.

Figure 22

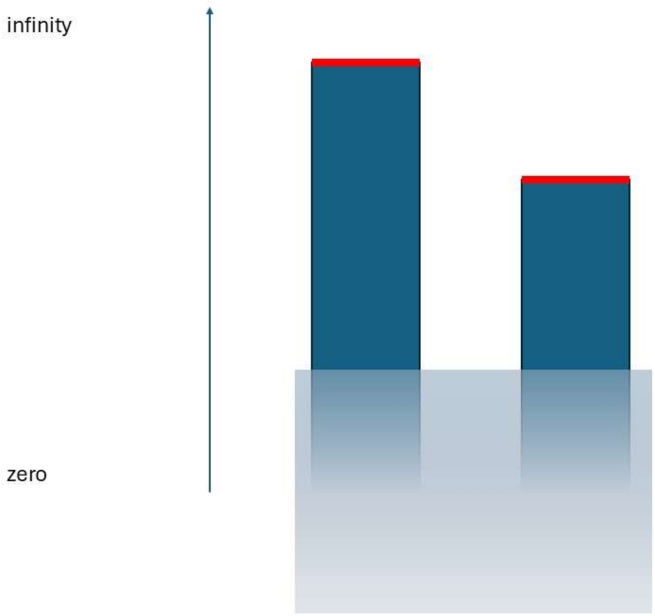


Figure 22 shows two lengths for which the zero point is not recognizable

We have two lengths. However, we cannot determine the absolute values of the lengths. The only recognizable features are the two red edges. We get a difference. In order to assign a value to this difference, we simply set the origin (at a speed of rest, this is rest) on one of the red edges. We can set the origin arbitrarily purely from a mathematical point of view. We do not know the “real” origin. Intuitively, we choose one of the edges. It is also important for us that this difference is necessarily symmetrical. So far, everything should be clear. I also assume that many people have understood this as we have described it. In the next section, it looks different.

4.2.3 Relativity with Lorentz transformation

What did Einstein do that I think of him as such a joker and make my daring statement about understanding SRT? His two principles are:

- Relativity
    - There is no identical minimum or maximum measurement point for all observers.
    - There must be no absolute value.
- Speed of light
    - There is an identical maximum measurement point for all observers, the speed of light.
    - Since the Lorentz transformation comes from an ether theory, there must be an identical state of rest for all observers, the minimum measuring point.
    - very value is an absolute value.

The two principles are mutually exclusive. That is what I meant, that the Galileo and Lorenz transformations do not agree on basic assumptions.

We can also see this very well at another point. In the Galileo transformation, the boxes may be at rest or in rectilinear uniform motion. Just an inertial system. But rest has been thrown out because we cannot determine it. For Einstein, every box must be a system at rest. Each box sits on an absolute reference point, each for itself. If anyone ever comes across a textbook that even begins to address this line of argument, please let me know.

4.2.4 SR reinterpreted

This immediately raises the crucial question: how does the SR work at all? It can never result in a principle of relativity. But it does, only not in the way that anyone would imagine. In the two theories of relativity, fundamentally different things are compared with each other. But no one comes up with it. The line of argument in the textbooks is always first Galileo and then this relativity principle, modified by Einstein, to the SR. Here I am also not sure whether this difference was recognized by Einstein himself. By this approach, we simply transfer the idea of Galileo's relativity principle to the SR. This approach is wrong. To clarify this, we have to do what? Exactly, ask the next fundamental question.

What kind of objects are compared in Galileo's principle of relativity? First of all, our two boxes. The boxes in relation to what? Only to themselves, since we have lost the reference point. The reference point in relation to what? The surrounding space. We can only speak of space with Galileo and Newton. A space-time with a dynamic definition of length and time was not yet known here. In general, this means that we compare the different objects in identical space. That is clear to everyone, what else could it be? This unquestioned basic structure is now transferred to the SR. As we have learned from the two principles, the SR cannot do this. The SR must do something different.

I'll spare you the next round of questions and just give you the answer. The SR is still a relativity principle. These objects must compare. But these are not our boxes in a spacetime. The SR compares spacetimes, which are each assigned to a box.

4.2.5 Relativity between spacetimes

Can we create a relativity principle between spacetimes? Let's take a look at a comparison according to the SR.

Figure 23

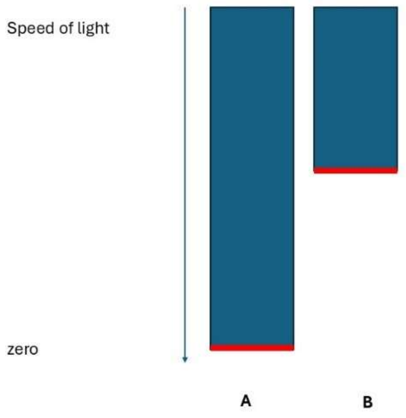


Figure 23 shows two lengths with an identical end point (speed of light) and different start points (rest)

Here we see two lengths again. Both start from zero with a different length in relation to each other. Both lengths start from zero in their space-time. Then we still need the end point, the speed of light. This must be identical for all. Otherwise, a comparison is not possible with different geometries.

Figure 24

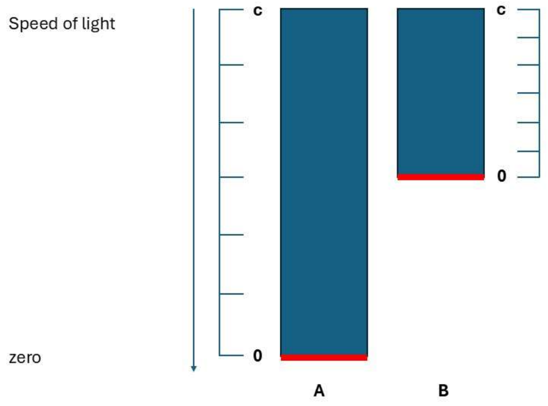


Figure 24 shows two lengths with an identical end point (speed of light) and different start points (rest) with the measurement divisions

For this, a different length scale must be chosen at B. The number of scales must be the same in both cases. From zero to the speed of light should be the same for everyone. This comparison is symmetrical again. We could set the rest system at A and at B. Thus A and B can each be an absolute value in space-time A and B. That's not a problem. No comparison is made in the respective space-time. The space-times A and B are compared. We see that the relativity principle also works between differently defined space-times.

Then our condition, no reference point, must work for the space-times themselves and not just for an object in the space-time. The space-times in relation to each other must not have an absolute reference value. To do this, let's look at the structure of a normal space-time diagram.

Figure 25

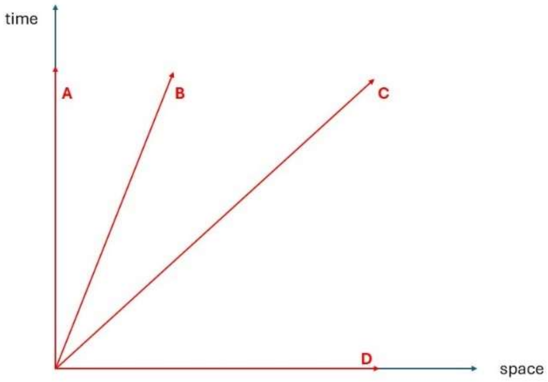


Figure 25 shows various possibilities for a movement in a space-time

Let’s look at the possibilities:

- Arrow A: We only have a movement in time but not in space. No change of position in space, but time still changes.
- Arrow B: We move with a freely chosen speed in space-time
- Arrow C: We move with the maximum speed of light through space-time
- Arrow D: We only move in space and not in time

In all cases, we are moving, even if only in time or only in space. What does not exist explicitly for a space-time is rest. Even if there is no object in the space-time and only the space-time itself would be present, time passes. This is also a movement in the mathematics of the SR. A space-time as an independent object does not know a state of rest. Fortunately, we have lost our way again. Within space-time, we simply set a point of rest and generate absolute values. This is not possible for space-time itself.

But what about a maximum speed? We do have the speed of light. Yes, but it is now absolutely necessary for a comparison to be possible at all. If both space-times have different geometries, there must be a common reference point for a comparison. Otherwise we could not even specify a difference.

For spacetimes, we can only define a reference point, the speed of light, and obtain a genuine principle of relativity between spacetimes, due to variable geometry in spacetime. That is the ST. With that, we can solve several problems at once. We can use it to explain why the twin paradox is so difficult for the SR, which we will do in 4.7. We can clarify a point that I have called cherry picking, which we will do in 4.6. We can explain why the SR fits better with QFT than with GR, in 4.8. We will see that with this interpretation, the SR really makes sense.

Before all these points can be resolved, we need to approach it differently, then these solutions will become even clearer. We first have to build the new view of the DP. This should combine Galileo’s relativity principle, everything in one spacetime, and Einstein’s relativity principle, comparison of spacetimes. We have compiled all the necessary components for this in 4.2.

4.3 SR for the DP

We do not introduce a new name for this variant of SR. The old variant according to Galileo and Newton is simply the principle of relativity. The variant according to Einstein is SR and we have now realized that this is indeed very special. For our new variant, we simply stick with the name SR. Since SR is mathematically identical in both variants, we do not need new names.

What do we want? We want a comparison of two objects in a spacetime. Because that’s what we actually mean when we speak of a principle of relativity (Galileo). Then we have to be able to deal with different geometries of spacetime in a single spacetime, without the need for an absolute value. As mentioned at the beginning, we do this with our spacetime density. This must contain all the required properties from both variants. Sounds very difficult again, but it’s easy. We have already incorporated this through our approach. We do not distinguish between stage and actor. A space-time density is always space-time itself. Thus, the property only has to be present, then it is automatically present in both variants. We can also divide the variants differently. In Galileo, the actors on a stage are compared. In Einstein, the stages are compared. We no longer recognize this difference.

What makes life easy for us now is that a space-time density is always energy, geometry and state of motion in one.

4.3.1 Space-time density without zero point

If we want to compare two space-time densities, there must be no zero point for a space-time density. We have covered this in detail in chapter 3. There can be no space-time density of zero. Otherwise, the point in space-time is not present in the space-time. That's all we need to know for this section. By definition, there can be no zero point for a space-time density.

4.3.2 Space-time density without a maximum reference point

At a higher momentum, we have more space-time density. I can relate this to the speed of light. The limit for the space-time density is infinity. Thus, there is no limit. However, for the state of motion, there is an absolute value, the speed of light. This means that there is a reference point. Thus, there should be no principle of relativity in DP at speeds. Unfortunately, it's not that simple.

For the ST, it was important that the speed of light is always identical for each space-time, otherwise we would not be able to compare space-times at all. We have to be able to determine a clear difference. This is only possible between spacetime if there is an edge/measuring point from which we can measure. Without the absolute speed of light, the comparison between spacetime makes no sense. For different geometries, there must be a starting point for the comparison, otherwise not even the comparison is possible. Otherwise we would have no suitable edge/measuring point for comparison.

We have the speed of light in spacetime. This is clearly defined by the geometry and thus an absolute value. The statement is correct. Nevertheless, we have no reference point in space-time. We only have it between space-times. We do the trick here as with Newton with rest. There we had rest or rectilinear and uniform motion. Since we cannot distinguish between the two states, the zero point has been eliminated. Something similar happens to us with the speed of light. This is always identically far away for every object and therefore cannot be used as a reference point for a measurement within a space-time. That was Einstein's basic idea. But there it is a postulate. We cannot use it that way. We have to derive this constancy of the speed of light. We will do that in the next section.

4.4 Constancy of the speed of light

We have discussed the existence of the speed of light in detail in chapter 3. As a structure element of space-time, it is necessarily given by the space-time boundary. However, this is only the first step. We have an identical condition. This explicitly does not produce the constancy of the speed of light.

The second step is that we have to show that, despite this condition, we have an identical distance to each object. There are two possibilities. One of them is wrong. Unfortunately, the wrong possibility is used very often. Let's take a closer look at the two possibilities.

4.4.1 Velocity is a fraction

We already had this topic with the Planck values. The velocity is a fraction $\frac{length}{time}$. This means that there are an infinite number of values that lead to the identical velocity. In the SR, the length and time dimensions change identically. This means that the value of the fraction as a whole does not change. The length and time become smaller and larger to the same extent. The speed does not change and must remain the same locally.

One part of the argument is correct. We cannot detect any change. Unfortunately, the second part, that this happens because the speed does not change its value as a fraction, is wrong, even though it looks right.

The best counterexample is the Shapiro delay, as it is well confirmed experimentally. We discuss this in more detail in the next chapter for the equivalence principle of GR. What is important for us now is that light in a gravitational field can also move more slowly for an external observer. Locally, however, the light must travel at c again. Here, length and time change in opposite directions. This never results in a locally constant speed over a fraction. We need a more general solution that also works in the presence of gravity.

4.4.2 No detectable change

The first thought was that we can detect the changes, but that they cancel each other out. For the constancy of the speed of light to work, we must not be able to detect a change in the components of space-time locally. Then it is irrelevant what the environment looks like or how the space-time components behave in relation to each other. We achieve this by defining the geometry as the determining factor for the space-time density. Since everything in the universe is a space-time density, the local constancy of any given quantity is achieved.

Let's start with length. The change in the space component can be whatever we want, we can never detect it locally. The meter as a reference size is not squashed. It is **defined differently** locally for the object. If a spaceship flies at about 86% of the speed of light, then the meter is only half as long for us in the direction of motion. However, there is physically no way to determine this in the spaceship. Absolutely everything in the spaceship now has the new length definition. A meter always remains a meter locally. We cannot even recognize the change.

Time behaves identically to length. The second is now defined differently. There is no way to determine this. But we have defined time as a measure of distance to the space-time boundary. The spaceship has moved closer to the space-time boundary. Yes, that's right. Locally, we can't determine that either. We would have to be able to detect a length contraction or a time dilation to be able to determine this. We lack this possibility. From the point of view of the spaceship, it has not moved an inch towards the space-time boundary. Therefore, locally everything remains as it is.

Locally, it is not possible to detect a change

Locally, no approach to the space-time boundary is recognizable. This must always remain identically distant. Constancy of the speed of light.

This "locally no change recognizable" not only has the constancy of the speed of light in its luggage. This also explains why, according to the SR, we can put everything in a rest system. The distance to the space-time boundary does not change locally and there is no zero point. Thus, any object can be considered at rest without acceleration. This is the connection between the SR, the comparison of space-times, and the old relativity principle, the comparison of objects in a space-time.

4.5 Example of the SR according to DP

Let’s look at the relativity principle in the DP using an example. We’ll do the classic here and take one person on Earth and one in a spaceship moving away from Earth.

Figure 26

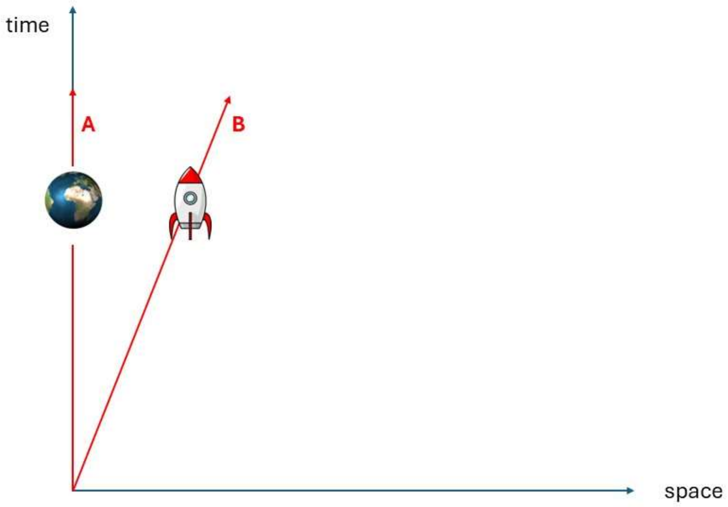


Figure 26 shows the Earth at rest and the spacecraft moving at a speed below the speed of light.

Then we have to discuss two points of view. One from Earth and one from the spaceship. We start with the simple case.

4.5.1 View from Earth

Here, SR and DP agree on the point of view. Therefore, the case is simple. The person on Earth experiences no change in the state of motion. Thus, the space-time density remains identical. For the SR, this person simply remains in the rest system. The spaceship is accelerated and thus actually acquires a higher space-time density. The spaceship experiences length contraction and time dilation. This can be measured from Earth. However, nothing can be recognized in the spaceship. So far, there is agreement.

Length contraction and time dilation are a real physical change in the spaceship. It is precisely this statement that leads to the assumption that the space-time density is not subject to a relativity principle.

4.5.2 View from the spaceship

With the SR, everything seems very simple at first. When the spaceship has completed its acceleration phase, it can claim to be at rest. The Earth has accelerated and is flying away from the spaceship. The Earth must now be subject to length contraction and time dilation. A perfectly symmetrical view.

This is exactly where the problems begin in understanding the SR. The acceleration phase has only and exclusively taken place on the spaceship. Why should the Earth be any different than before? The Earth is not enough. In the direction of motion, the entire universe must have accelerated. No, certainly not. The universe does not change just because a spaceship has had an acceleration phase somewhere. This is the best way to see that the SR does not compare two objects (Earth and spaceship) in one space-time. Depending on the point of view, the objects are assigned a suitable space-time, which always goes from zero to the speed of light. Then the comparison of the spacetimes is made. Therefore, from the point of view of the spaceship, the entire universe must have undergone a change. Only the spaceship has been given this new definition of spacetime. However, it is a definition of a complete spacetime.

However, the SR only knows one direction when making a comparison. The other object always has the “smaller” definition with time dilation and length contraction. In a relativity principle, there should only be a difference and no specific direction. This, in turn, is a forced result of the approach with the Lorentz transformation from an ether theory. This only assumes an identical zero point throughout the entire universe. Therefore, we get this preferred direction in the comparison in the SR.

In the DP, only the spaceship may have the higher space-time density. Only there has an acceleration occurred. Then the spaceship has a changed definition of geometry. The spaceship recognizes, just like the Earth, that there is a difference in the definition of geometry. Only this difference is recognized. Even if it is clear to the spaceship which one must be the one with the higher spacetime density, we cannot measure this from the spaceship. In the spaceship, a different definition of geometry is now in place. The spaceship may now only recognize all outward observations with its definition. Let’s proceed strictly according to SR. Then the spaceship is at rest and the earth has accelerated. What does it look like for the spaceship after the DP? The earth has definitely maintained its speed. But with that, so has its space-time definition. The meter of the earth is defined longer than the meter in the spaceship. Then the earth, from the point of view of the spaceship, creates more length at the same speed. Thus, from the point of view of the spaceship, the earth must have accelerated. Not just the earth, the whole damn universe. Only the spaceship has changed its space-time density. Thus, for the spaceship, the entire universe must necessarily be subject to change.

DP only makes a spacetime change to the object that has also had an acceleration phase. But then there is a global change for the object. SR does this by always assigning a complete spacetime to each object. Then the DP and SR perspectives seem to be identical. So why all the fuss? Because they are not identical.

In DP, the spaceship actually has a higher spacetime density. In SR, we cannot determine this in this way. We can only use a symmetrical approach. In DP, it is clear that length contraction and time dilation are only local phenomena. In SR, these are always global depending on the point of view. We will clarify these two points in the next two sections.

4.6 Cherry picking in SR

According to the SR, time dilation and length contraction always occur identically and physically measurable in all of space-time. But then we get a logical problem. Mathematically, everything is clean because it is symmetrical. Logically, it becomes critical here. The approach from the DP solves this problem very easily.

As always, I have named this problem “Cherry Picking” by virtue of sovereign arbitrariness. When I sit in my chair and write the text, I have a defined time and a defined length between my two hands in front of me. Now muons are continuously approaching this length from all sides of the earth’s atmosphere. Since muons are very fast, the length must be different for these particles, depending on the angle to my hands. We cannot really imagine that.

Almost all discussion partners make a rather idiosyncratic distinction here. Each muon must have a different time than mine. These are different objects from my hands. These can have different time courses. Since time remains a mystery, this is simply accepted. This is a good thing, since time dilation has since been verified with impressive accuracy in experiments. Chop on that.

According to the SR, however, the length must also change physically. Time dilation only exists with length contraction. If time dilation is measured experimentally, then, conversely, length contraction must also occur physically. This means that the distance between my hands must constantly be different. Depending on the angle at which the muon moves in relation to my hands. Almost no one accepts this. Many people leave the path of virtue and go for what is logically understandable. Length contraction is only a point of view; time dilation is real. From a logical and mathematical point of view, this makes no sense in the SR. Either both are just a point of view or both are physically measurable. We are certain about time because it has been measured. We do not want to accept it when it comes to length, which is just “cherry picking”. The problem arises from the fact that the ST always assigns a complete space-time. In fact, it does not make logical sense. However, since the math works very well => shut up and calculate.

In DP it is clear. There is always a real physical effect. However, this is only local in the object. From the object, the appropriate view of the rest of the unmodified universe then arises. Cherry picking is not needed.

4.7 Twin paradox

Sorry, but if we go through the SR, the twin paradox must not be missing. In particular, we can use this paradox to clarify the problem with information about a greater or lesser density of space-time. Most of the other paradoxes (e.g. garage paradox) are rather uninteresting. These can always be explained by the symmetrical view, by the non-existing simultaneity. But in the case of the twin paradox, there is no symmetrical result. There must be a reason for this.

In mathematics, there is no difference. Even the SR has the result that the twin in the rocket is always the younger one. This is also the expected result in the DP. In the SR, however, it is not clear why this is so. The argument is often a symmetry break or something similar. For a better understanding, we extend the twin paradox to triplets.

Figure 27

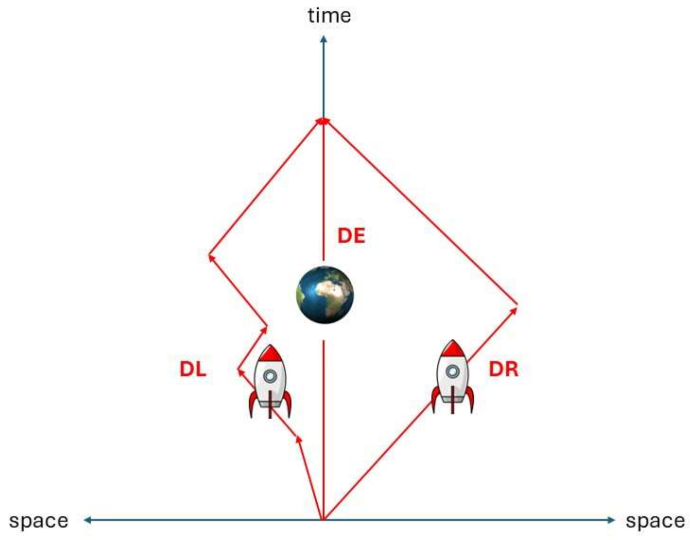


Figure 27 shows the Earth at rest and the two spaceships with their motions in space

There is a triplet on the left (DL), a triplet on the right (DR) and a triplet on Earth (DE). DR has a single destination and DL visits several places. DE stays on Earth and only moves forward in time. What may not be 100% recognizable in the picture, the distance traveled by DL and DR should be identical in total.

The result is clear. The triplets are the same age at the starting point. When they meet again, DL and DR will be the same age because both have traveled the same distance through space-time, and DE will be the older of the three.

In the DP, the result is logically to be expected. Only DL and DR experience an increase in space-time density. Only DL and DR can experience time dilation compared to the starting condition. It does not matter in which direction the time dilation occurs. Only the sum of the time dilation, that is the distance traveled, is relevant in the end. There is information here from younger and older or from smaller and larger space-time density.

This is not clear from the SR. The SR is always symmetrical. Thus, between DE and DL, the other should experience an identical time dilation and there should be no difference. However, the result looks different. Why is that? I have not yet read a good explanation for this. What comes up most often is the most obvious explanation. If the symmetry is no longer given, then it must have been violated. Because nothing else is there, the culprit is quickly found. The evil, evil acceleration. This must break the symmetry. Then come even worse statements, such as: “The SR cannot deal with acceleration”. What nonsense. The SR just can’t handle gravity. Any kind of classical acceleration can be incorporated 100% error-free into the diagram or the calculations.

So, now let’s calm down and tackle the solution. If the information is not already present, we could not get it. We cannot create additional information. The information must always be included. In the DP, we always have this information. We just can’t determine it in the SR. This can only be obtained under certain conditions. That’s the right approach.

It can’t be the accelerations. We expanded the twins to triplets so that this would become visible. We could also let DL fly through space-time at a faster pace. If the sum of the distance traveled in space-time is identical, DL and DR are identical in age. The number and direction of the accelerations do not matter. The acceleration is only necessary so that there is any change in the space-time density at all and the triplets can meet again.

What many people do not realize is that in the classic twin paradox, the twin in the spaceship breaks symmetry twice. The first time when he starts from Earth. The second time when he starts again from the intermediate destination. Then the first symmetry break is a “good” one, since everything is still symmetrical, and the second symmetry break is a “bad” one that ruins everything. That doesn’t fit.

Let’s go back to the basics. When did we have to switch from an absolute value to a relativity principle? When we lost reference points for measurement. If we want more information, there must be a reference point again that can indicate this information. The picture again with the two important points.

Figure 28

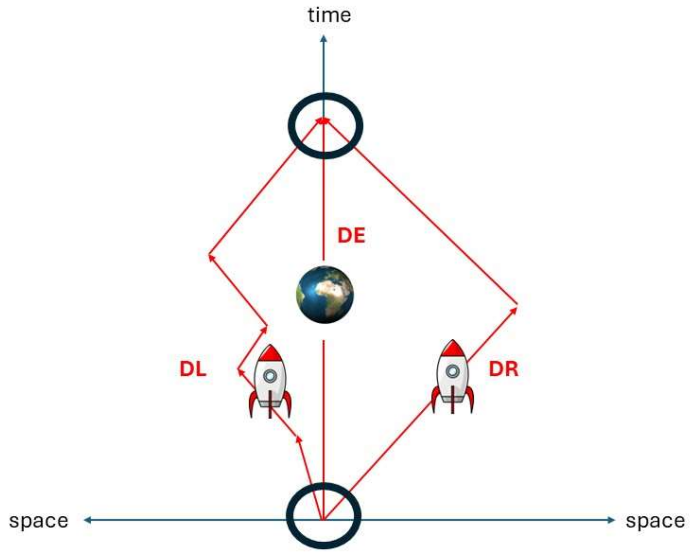


Figure 28 shows the triplets with a reference point

What is special about this paradox is the starting and end point. The starting point is identical for everyone in every piece of information. The end point has remained identical in space and shifted in time. It should be the identical point in space and time for the triplets. We have created an additional reference point for the measurement within the relativity principle. This gives us all the information about space and time that differs from this reference point in the relativity principle. Then, in the SR, there is also a younger and older one.

4.8 SRT on QFT and ART

The last section in this chapter deals with the fact that the naming of SR and GR, well, let's say, was a disaster. We can't change the names anymore. These suggest that the SR is the little sibling of the GR. I want to contradict this here. From a purely mathematical point of view, I can still understand the statement. From a logical point of view, it is simply wrong. At this point, too, it is clear to see that a great many people can do calculations well with the SR. But only a few have understood the SR. We will stick with the approach from the DP.

What does the GR do? This theory states how the space-time components change due to space-time density. This statement only makes sense within a single space-time. The space-time density is only the source here. The actual statement does not concern the space-time density. We can see this from the fact that the GR creates a singularity. This is not possible with the approach of a space-time density. For the GR, only the amount and distribution of the space-time density over the space-time dimensions is of interest. The curvature of space-time must then compensate for this. The GR makes statements about the curvature of space-time. Thus, the surrounding space of the space-time density in a single space-time. There can also be several space-time densities, spatially separated. This statement of the GR concerns the surrounding space-time.

What does the SR do? In the old view, different spacetimes are assigned to the objects and compared. This only makes it appear that the SR makes a statement about spacetime. The SR cannot do that. Different spacetimes are compared. The SR cannot make a statement about a single spacetime or a single object. We always need at least two objects, otherwise the SR makes no sense. In DP it becomes a bit clearer. SR compares the definition of the space-time geometry of different space-time densities. These are statements about one space-time density. Just because the rest of the space-time appears different from this definition, we believe that SR makes a statement about space-time. Clearly in DP, everything is space-time, so every physical statement is somehow a statement about space-time.

The SR makes absolutely no statement about the surrounding space-time of a space-time density. This is only the comparison of space-time densities. The GR needs a space-time density as the source of space-time curvature. Otherwise, however, the GR is not interested in the space-time density and only makes statements about the surrounding space-time. From this we conclude:

The GR and the SR result in two completely different statements.

The SR is simply contained in the GR because the relativity principle must be incorporated into all physical statements in the DP by definition. Everything is spacetime density and this is always subject to the relativity principle.

So what does QFT do? It describes the “inner structure” of a space-time density through low-dimensional spaces (fields). However, QFT is only interested in the space-time density. The space-time density is not aware of any space-time curvature. QFT only uses the surrounding space-time of a space-time density as a “given possibility”. A low-dimensional space-time density cannot determine whether this surrounding space-time has a curvature. Thus, the surrounding space-time is uninteresting for QFT. Therefore, SR and QFT can be unified to a certain extent. Both look at space-time densities and not at the surrounding space.

We will end the chapter here and take a closer look at GR in the next chapter.

5 Principle of equivalence

ART is based on only 3 principles

- Relativity
- Speed of light
- Equivalence

We have already derived the principle of relativity and the speed of light in the chapter on relativity. The equivalence principle is still missing for GR. There are two of these. The weak and the strong equivalence principle. We will deal with both separately. The strong one is sufficient as it contains the weak one. Hence the names chosen. The separate derivation is interesting for the logical structure. The astonishing result of the derivation is that spacetime itself is a potential field. This becomes very important again in cosmology, in a different form. Here, the vectorial potential field of spacetime is identical to the potential field of gravity. All other potential fields in physics function according to the same principle. In QFT in different spacetime configurations.

In this chapter, we will also clarify what a force is in the classical description of physics. This will help us to understand gravity. Einstein's ingenious idea of a force as a geometric representation in spacetime is not always immediately understandable. We then recognize more easily why we can use such different descriptions for an identical phenomenon.

5.1 The weak equivalence principle

Let's start with a weak principle and then we can improve it. The weak equivalence principle is already included in the good old mechanics of Newton. In classical mechanics, however, it was unclear why this is so. Here, the principle is often referred to as the equality of inertial and gravitational mass.

5.1.1 First and second axiom of Newton

What Einstein's $E = mc^2$ is for Newton $F = ma$. he two most famous formulas in the world. Force equals mass times acceleration. Newton's second law. The mass m in the formula is the inertial mass. Inertial because it does not change its state of motion when no acceleration acts on it. No acceleration, no force, and thus no change => inertia. Since mass is the only object in the formula, this inertia must be associated with the mass. So far, so good.

So why is there a first axiom? Well, do you know it off by heart? I'll help you: "A body at rest in a force-free environment remains at rest or moves in a straight line and uniformly". We already had that in the second axiom. No acceleration, no change. Why is this statement in two separate axioms? To make sense of this, we have to read the first axiom differently. We turn the statement around: If no forces act on a body, then what the body does is rest or a straight-line and uniform motion.

The first axiom is a measurement specification. We can measure what a straight and uniform motion is. In a spacetime with spacetime curvature, "straight" is not so easy to determine. This makes a popular statement about gravity questionable. A body in a gravitational field falls force-free in a straight line to the center of gravity. We will see that this statement should be treated with caution. Here we will learn about the difference between the potential field and the force.

5.1.2 Equivalence of inertial mass and gravitational mass

Newton's next famous formula is the formula for gravitational force

$$F = \frac{G \ast M_{heavy} \ast m_{heav}}{r^2}$$

The capital M shall be the earth and the small m a test mass. The mass here is the heavy mass. That which the scale indicates. We put this formula together differently.

$$F = \frac{G \ast M_{hea}}{r^2} \ast m_{heavy}$$

The first term with the fraction is, according to the units of measurement, an acceleration. For the earth as M, the well-known small g for the acceleration due to gravity comes out here. This gives:

$$m_{inert} \ast a = g \ast m_{heavy}$$

If anything is to fit together here, then we must be able to cancel out the different m or g and a. This leads us to the following statements:

- Inert and heavy mass must be identical.
- Since you can abbreviate the masses in order to describe only the acceleration, no properties of m may be relevant for the effect of the acceleration. Shape, size or chemical composition, all this is meaningless. Result: On the moon, a hammer and a feather fall identically to the ground.
- You can already see here that the effect of gravity must be treated like an acceleration.

The identity of inertial and heavy mass was a mystery to Newton. You can see that it must be so, but there was no reason for it. This identity has been very carefully examined in 2025. There can only be a deviation after the 14th place behind the decimal point. One of the best-examined values ever.

5.1.3 Equality in the DP

In the DP, the approach is completely different. Each mass is a spacetime density. There is no characteristic for a distinction. All known characteristics for a distinction lie in the QFT and not in the ART. Thus, these characteristics must not produce any difference when a "force" is exerted via gravity. We do not have to justify equality, it is necessarily given by the approach. We turn the tables. We don't even have the option of describing a difference.

If a difference is ever detected, no matter how far behind the decimal point, the DP is falsified.

5.2 The classical concept of a force

Somehow there must be a connection between force and gravitation as a geometric figure. The strong equivalence principle refers to an acceleration. In classical mechanics, this always produces a force. The solution is already contained in Newton's axioms. First and second axiom: A force is a change.

In DP, we can understand the classical force as a change in the density of spacetime. Without an interaction, a density of spacetime remains what it is. It can change through an interaction. That's very simple. But we have a big problem, especially with gravity. What is exchanged in an interaction? The long-sought graviton as the exchange particle of quantum gravity? No, definitely not!

In GR, there is only a geometric mapping as spacetime curvature for gravity. All mass-energy equivalents are collected in the energy-momentum tensor. In the Einstein tensor, we have no spacetime density as exchange particles. However, we still need a change in a space-time density. This is precisely where the strength of the DP lies. We have a curvature or a density, that's all there is. It cannot be a density. There is only one possibility left. The space-time curvature must cause a change in the space-time density without an exchange particle.

Ultimately, we have to come up with the strong equivalence principle. There, gravity must be indistinguishable from an acceleration in its effect on a mass. Thus, space-time curvature must produce a change in space-time density that corresponds to an acceleration. One could also have concluded the DP if one wanted to fully explain the concept of a potential and here the gravitational potential. Unfortunately, people were already satisfied with the exact calculation. The why was no longer interesting.

For us, force is a change in the density of spacetime. Since the density of spacetime is also a state of motion, it should come as no surprise that acceleration is associated with force. Changing a state of motion requires acceleration. This clarifies the concept of force. Let's move on and finally take a look at the strong equivalence principle.

5.3 The strong equivalence principle

In the strong equivalence principle, the **effect** of gravity cannot be distinguished from acceleration. These do not have to be identical, we just must not be able to distinguish the effect.

We saw the first approach in the weak equivalence principle. There, a and g had to be identical. Einstein then came up with the idea that a motion in a curved space must correspond exactly to this acceleration. As we can see from the word "effect", it was already clear to him that this is realized with different phenomena.

Figure 29

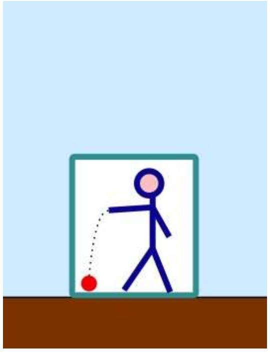
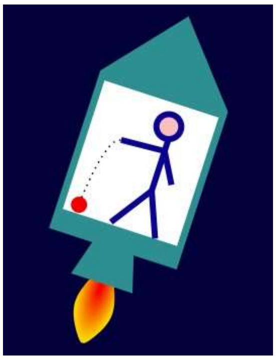


Figure 30



Figures 29 and 30 show a closed "box". On earth or in a spaceship with acceleration

We are once again traveling with the locked box from Galileo. With the SR, it was without an external effect. Here it is gravity and the rocket with acceleration. In both boxes, we cannot determine with any experiment whether it is gravity or acceleration. The effect is identical.

5.3.1 The problem with “falling”

Since a deformation of space-time was not very useful at the beginning of the GR, the old analogy with acceleration was used. In order to obtain an effect like acceleration, the test object m must “fall” into the center of gravity in curved space-time. I believe that this analogy has slowed down the search for the why-question. The moon falls to Earth. Since space-time is curved, the moon falls on its orbit around the Earth. This can also be calculated very well. Everyone can understand this and everyone is satisfied.

Not us! This analogy explains nothing. According to the calculation in the GR, the moon moves on a geodesic around the Earth. This term describes the direction of motion without the influence of a force. In spacetime without gravity, this is a straight line. With gravity, it is the almost circular orbit around the Earth. Force-free, that reminds us of Newton’s first axiom. In a flat spacetime, it is straight and uniform. In a curved spacetime, it is always following the curvature. But that is exactly the measurement specification that says the moon is not subject to any interaction. No acceleration and therefore no change. Where should an effect as acceleration come from? The first axiom and the second axiom mutually exclude each other when it comes to acceleration. In the GR, however, it is assumed that both can be present at the same time. The force-free moon (since on geodetics) falls (and thus accelerates) around the earth. No, it doesn’t work that way.

Let’s calm down a bit and continue. No interaction from the outside and yet we still need a change. This change remains constant over billions of years, using the moon as an example. This question has never been solved. So let’s do it now.

5.4 Energy conservation

The first idea we can have is that the value of the space-time density changes in a space-time curvature. Then we have no interaction from the outside and yet a changed value. That sounds very much like the solution we are looking for. In the space-time curvature, the length increases and the length of the space-time density remains the same. Then, in relation to the space-time density, the density increases. Thus, the space-time density receives a perpetual change = acceleration from the environment. Yes, but we have space-**time**. With the time dimension, it is exactly the opposite and everything balances out again.

Don’t be sad, it’s a good thing. We need energy conservation. The space-time curvature does not change the space-time density for its area. You remember the constant surface area. Thus, the ratio of a space-time density to the surrounding space-time with space-time curvature does not change either.

Ultimately, we have no interaction from the outside. Thus, the ratio of the spacetime densities of the environment and the object cannot change. However, we only have spacetime curvature and spacetime density, so where can it come from?

Attention! To simplify matters, I only explained the facts with length in the YouTube channel. This is not correct. There is no black hole in a black hole. Here, too, I’m afraid I have to say “sorry.” At the time, this wasn’t 100% thought out.

5.5 Change in the components

The only thing left now is the shifts between space dimension and time dimension in the curvature of space-time. Let's take a closer look.

A space-time density moves towards the earth at 1 m/s. Far away from the earth, this is a straight-line and uniform motion. Since we have no interaction from the outside, the speed must remain the same. However, in the curvature of space-time, space and time change their definition. The meter becomes longer and the second becomes slower. But this only happens for the surrounding space-time and not for the space-time density. The speed must remain at 1 m/s. So the space-time density must become faster. It now has to cover a longer distance in less time. The space-time density is accelerated simply because of the change in the dimensions of space and time:

This somewhat strange acceleration is exactly what we need:

- No change in the space-time density
- No interaction from the outside
- The space-time density is always subject to this acceleration
    - I am writing this text while sitting on a chair. So no movement.
    - Why do I feel my weight? I am not falling towards the earth right now.
    - Newton's first axiom also applies at rest.
    - The difference between the definitions of space-time curvature and space-time density alone causes the acceleration. This also exists at rest.
    - Since every spacetime density has a spacetime volume, this difference in spacetime density is always present. The part that is closer to the gravitational source has a greater difference than the part that is further away from the gravitational source.
- The acceleration is therefore always aligned with the spacetime curvature
- The acceleration comes from the change in the surrounding spacetime.
    - The properties of the spacetime density do not matter.
    - The acceleration is identical for any spacetime density

The strong equivalence principle arises from the counter-rotating deformations of the space and time components in a spacetime curvature. The spacetime density is not changed. Here we see again how important it is that this deformation is a change in definition and not just a point of view. The equivalence principle only works if the definition is changed.

5.6 The opposite effect: Shapiro delay

A change in the components can also have the opposite effect. This happens when acceleration no longer allows the speed to be increased. We have to consider the special case of the speed of light. Here we have two possibilities:

- A change in wavelength. This happens in the red or blue shift. We will discuss this in the next section when we take a closer look at the concept of potential.
- A reduction in speed. There is no change in wavelength, or rather, blue and red shifts cancel each other out. However, the distance traveled becomes longer due to a change in definition. The space-time density with its speed no longer manages the identical distance. The light cannot become faster. It cannot accelerate further. Thus, with a longer distance and less time, the light must slow down. This is the Shapiro delay.

To see this, let’s look at the following picture:

Figure 31

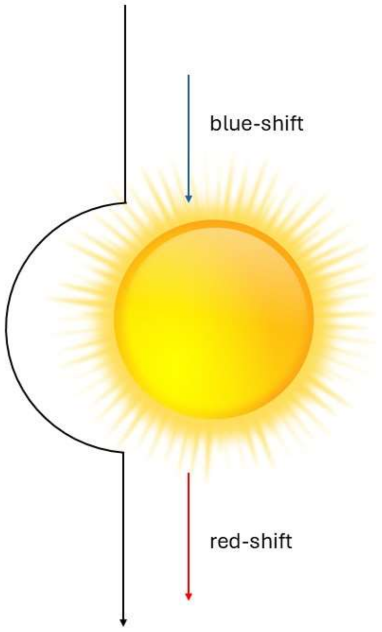


Figure 31 shows “very exaggeratedly” how a beam of light is “extended” around the sun.

A photon traveling at the speed of light passes very close to the sun. As the photon travels towards the sun, it undergoes a blue shift. When it travels away from the sun, it undergoes a red shift. There is no change in frequency.

However, the photon must follow the curvature of space. This results in a longer path for the photon. Then it must simply fly through the longer path at the speed of light and everything is perfect. This was also the idea until Mr. Shapiro, for light in the mathematics of GR, discovered a deviation. Light signals must show a lower speed when flying past a mass. The effect has been experimentally confirmed to about 4 decimal places.

Even at the risk of you being sick of it. Here, too, we see, as with the equivalence principle, that the change in the space-time metric must necessarily be a change in the definition of geometry. If this curvature were just a longer distance, then this effect would not occur.

The photon has the maximum speed. In the space-time curvature, by definition, the path becomes longer and the time shorter. It is not possible to accelerate. The photon becomes slower for an observer in this environment. Locally, the photon retains the speed of light, as we discussed in the SR.

5.7 The gravitational potential

The final act for this chapter should be the gravitational potential. From my point of view, the term potential is one of the least understood but most frequently used terms in physics for calculations. If it doesn’t have to be 100% exact, then we always calculate with the potential and not directly with the curvature of space-time when dealing with a problem involving gravity. Otherwise it’s much too complicated. The trajectories of almost all the bodies that we have shot into space and will shoot into space in the future were calculated in this way.

If we ask a physicist what a potential is, the answer is almost always something along the lines of: the potential is the ability to convert potential energy into kinetic energy. Ok, where does this ability come from, is it in the body? Everyone agrees that this ability is in the potential and not in the body. The identical body outside of a potential experiences no acceleration. What then is this ability? In most cases, rest then sets in. The answer often comes: a property of the potential. We are back to square one.

For almost all potentials, it is important whether the test body participates at all in the interaction of the potential. A neutral neutrino is completely unaffected by an electric potential. In the case of gravity, we have the peculiarity that absolutely everything that we can identify as an object participates in the gravitational potential. This makes sense, since in the DP everything is a spacetime density in curved spacetime and must therefore participate. In the other interactions, the geometry in QFT indicates whether an interaction is allowed to take place.

We have another peculiarity compared to other potentials. In the case of an electric potential, the strength of the test body's charge plays just as important a role as the strength of the potential itself. Not in the case of gravity. It doesn't matter how much spacetime density the test body has. It is not about the value of the space-time density itself. It is about the deviation from the length dimension to the time dimension. This is always zero for the space-time density, since the space and time dimensions deform identically. The deviation comes only and exclusively from the environment with space-time curvature.

If we want to get out of the gravitational potential again, then we have to compete against this acceleration. We need a rocket. The acceleration is not just an apparent effect. A rocket must have a decent power output to successfully work against this acceleration. This time, we use the rocket to apply a force by interaction, and this will actually increase the space-time density. The state of motion of the space-time density (rocket) and thus the energy itself must be increased by acceleration to escape velocity.

The acceleration converts the kinetic energy into potential energy. This is the classic statement about a gravitational potential. In fact, nothing is converted into potential energy. The rocket must actually generate the acceleration against gravity through an interaction. The rocket comes out of the gravitational potential and then has a higher state of motion outside the potential.

Calculating with the potential is very simple. Energy conservation ensues because the mutual accelerations must cancel each other out. The energy of the rocket has increased in real terms. We simply assign a negative energy to the potential. However, the object, our rocket, has actually increased its space-time density when leaving the potential. In the calculation, all this is lumped together. With a negative energy in the potential, we get energy conservation and the calculations are very simple.

What about the special case of light? If we look at a photon in terms of waves, it's a bit easier. The photon doesn't necessarily have to slow down, it can do something else. If the energy of a photon is determined by its wavelength and acceleration corresponds to an increase in energy, then the photon can increase its energy at the same speed with a shorter wavelength. This is the blue shift. If the photon wants to get out of the gravitational potential, it works the other way around and we get the red shift. It has to use part of its existing space-time density to counteract the acceleration of gravity. However, this only works into or out of the potential. There is no Shapiro delay here because the acceleration can be mapped into the wavelength.

This explains the origin of the equivalence principle. To summarize again in a few sentences:

- Space-time density always has an identical change in space and time components. Therefore, the first axiom applies to all objects in our universe.
- Space-time curvature always has an opposite change in space and time components.
    - A space-time density does not change in a space-time curvature.
    - Thus, it cannot change its state of motion itself.
    - The ratio of space-time density to space-time curvature remains identical (area).

    - In order for the state of motion to **remain identical** (there is no interaction from the outside), for example 1m/s, a space-time density in a space-time curvature must experience an acceleration.
- If a graviton is ever discovered, the DP is falsified.
- Since everything consists of space-time density, everything must also participate in gravitation.
- Since light cannot be accelerated any further, a redshift, a bluedshift or a Shapiro delay must occur.
- The higher state of motion is, in the view of a potential, simply evaluated as negative energy (space-time density = state of motion = energy). Thus, the total energy remains identical. The space-time density has not been changed.

With this little explanation, it should now be clear why Lagrange and Hamilton work so well. This all comes from the conservation of energy. A spacetime density can only change and does not simply disappear or multiply.

With this knowledge, we can turn to cosmology. The development of our universe.

6 Cosmology

This is about the development of our universe. It is all based on the GR. We will have to broaden our view of the universe to include higher- and lower-dimensional spacetimes. We define that the term “universe” always includes all these spacetimes. A spacetime is just a particular spacetime configuration. The universe is a collective term for everything.

For cosmology, we will connect the spacetimes across the dimensional boundary to form a universe. This means that our universe is defined not by one spacetime, but by recursive spacetimes. Each of these spacetimes is a potential field in itself.

We can specify what the Big Bang really was, but we cannot determine its true origin. We can specify an object for dark matter, but this is not a new elementary particle. Dark energy is no longer needed.

Here, too, there is a fundamental question that is not asked often enough for me. Why is our space-time expanding? Is it space-time or just space as described in the textbooks? The field equations of GR show that a static universe does not work. GR does not really allow for a static universe. Yes, but mathematics do not force an object to do anything. There must be a reason built into this mathematical model.

In addition, we will learn about further “deformations” of spacetime in this chapter. The picture is not yet complete. These deformations are not possible in all spacetimes. This depends on the number of spatial dimensions. We need all these ingredients to build a clean and coherent picture for GR and the universe itself.

6.1 Recursive Universe

We have an approach with space-time density and space-time boundaries. Therefore, every n-dimensional space-time volume has an infinite number of lower-dimensional space-times and at least one higher-dimensional space-time. We look at how these affect each other across the different numbers of space dimensions. This will be important again later for Part 3 QFT. From this approach, it will also become clear that QFT and cosmology go hand in hand. Much more than in the standard model. We make it easy for ourselves again and start from zero.

6.1.1 0-space dimensions

This is very easy for us. We had already discussed this at the boundaries of space-time. That was the discussion with the mathematical abstraction of a point. There can be no space-time without a space dimension. We are done with that. Space-time without a space dimension will no longer be discussed.

6.1.2 1-space dimension

If we have one space dimension, then we always have one time dimension in addition. Thus, one space-time. In DP, there can only be one time dimension in a space-time configuration, since this is the distance measure to the space-time boundary.

The problem with only one space dimension arises from the GR. This cannot be mapped in a space-time with only one space dimension. The task is to determine the deformation of the space and time components in relation to each other. With only one spatial dimension, no space-time curvature can be determined. General relativity only starts with two spatial dimensions. Even if we could have a density and a curvature in only one spatial dimension from a purely logical point of view, there is no low-dimensional space-time to go with it. There can be no mass-energy equivalents, since there can be no low-dimensional QFT. However, these are the sources of spacetime curvature. Conclusion: In a spacetime with only one spatial dimension, there can be no mapping of spacetime density or spacetime curvature.

Does that mean 1D is out? No, not quite. For us, 1D is usable and must be used. Contrary to GR, we can work with extrinsic characteristics. This does not work in 1D. We get a higher spacetime density in 2D if 1D has an extrinsic characteristic there. In 2D, there is more 1D spacetime.

Figure 32

Figure 32 shows more 1D spacetime in a 2D spacetime over a wave.

We will need this again in Part 3 for the description of neutrinos. In cosmology, it is important for us to note that a 1D spacetime cannot have a mapping of a spacetime density and thus of a spacetime curvature. There can be no development within spacetime in 1D. No cosmology is possible within 1D.

6.1.3 2-space dimensions

In 2D, we are "almost happy", but only almost. We can fully map the GR in a 2D spacetime, with one crucial limitation. In scientific terms, the degree of freedom that allows spacetime curvature to propagate through space is missing. In layman's terms, everything is fixed. In 2D, there is no possibility for space-time curvature and thus also for space-time density to change.

We often imagine 2D as our 3D space-time "squeezed" onto a surface. This idea is completely wrong. No planet, no sun, no galaxy or life can form there. Something is either statically present or not. There are only two possibilities for a mapping:

- We can obtain a static extrinsic mapping as in 1D, e.g. a photon
- We can map a static black hole. e.g. an electron.

Nothing more is possible. The reason for this is simple. We don't have a low-dimensional QFT available in 2D. To map elementary particles, a QFT must be available. In 1D, we only have the possibility of an extrinsic mapping of a space-time density in 2D. This gives us neutrinos. We have reached the end of the line. We can only map neutrinos as elementary particles in 2D. Further mappings of a space-time density may only exist without a low-dimensional QFT. We already had that with the limits of space-time. Only a black hole is a spacetime density without a low-dimensional mapping. Cosmology is the development of spacetime. A black hole in 2D cannot have any development because everything is static.

2D is therefore out for cosmology. In particular, a 2D spacetime is very different from our 3D spacetime. The fact that 2D is completely static will benefit us again later in QFT.

6.1.4 3-space dimensions

We have finally arrived at our space-time. We will see that a 3D space-time is something very special. We have two "vital" features for us from 3D.

- From 3 spatial dimensions onwards, development within a space-time is possible. If there is one property of life that we can describe as the most important, then it is evolution. Without evolution, there is no life. Cosmology is the evolution of space-time. Since everything is space-time, life can only exist from 3D onwards.
- But evolution is not just change. Evolution is a change that occurs in stable steps. In order to have individual steps/objects or, better, elementary particles, we need a low-dimensional QFT. This is only possible from 3D onwards, since we only have a low-dimensional mapping in 2D space-time. All mappings in 2D are static. We can only determine the different possibilities of a 2D mapping in 3D when we take a measurement. The individual possibilities (states) that are available are also static in QFT. Only the mixing or selection of the possibilities remains open until the measurement. Without this static substructure, there would be no QFT as we know it.

With these small considerations, it should already be clear that life as we can define or understand it only and exclusively exists in 3D space-time. Since the rest of the chapter is almost exclusively about our 3D space-time, we can end this description here.

6.1.5 4-space dimensions

We must not stop at 3D. We have black holes in our space-time. These are the transition to a higher-dimensional space-time. This makes it certain that our 3D space-time is embedded in at least one 4D space-time. That's the good news and the bad news. Good, because this provides an explanation for the Big Bang. We describe the big bang in the next section. Bad, because we open Pandora's box with it. We get two big problems.

6.1.5.1 An infinite number of 3D spacetimes

We have determined at the boundaries of spacetime that every n-dimensional spacetime volume must have an infinite number of (n-1)-dimensional spacetimes. If there is at least one 4D spacetime, then there are also an infinite number of 3D spacetimes. If we look for an explanation for experimental findings from the cosmos, we get a new, huge solution space. The 3D spacetimes could influence each other. If we are looking for a "culprit" for dark matter or dark energy, something can certainly be built from an infinite number of 3D spacetimes.

We do it here like the GR. There, for reasons of parsimony, no higher- or lower-dimensional spacetime was explicitly assumed and everything was placed in the 3D spacetime. We will stick to this principle for the possible solutions. The first attempt at an explanation should always come from our spacetime. Only if there is no other way will we resort to the infinite number of other 3D spacetimes or the 4D spacetime.

6.1.5.2 QFT from 4D

If there is a space-time with 4 space dimensions, then we just have to increase our mathematics by one space dimension and then we can calculate everything again in 4D. This probably works well with the GR. It all gets a bit more complicated, but it is possible in principle.

With QFT from 4D, the fun stops. QFT from our space-time is already very complicated. This is just about manageable for two reasons. If you can say that at all.

- The mathematics is linear
- The individual possibilities are fixed. Only the mixing or selection of the fixed possibilities is subject to probability.

A QFT in 4D has 3D as a lower-dimensional substructure. In 3D, there is an evolution of the images in space-time. Nothing remains fixed. The possibilities of the images are only extrinsic characteristics and black holes in our 2D QFT. In 3D, there is everything that can be seen in our universe. The QFT in 4D must be unbelievably complicated. In addition, black holes form in our space-time. These are again a connection in 4D. This is the reason for the physical and mathematical worst case.

This is so far removed from anything I can imagine that I keep my hands off it. This makes 4D an absolutely unsatisfactory solution. However, we will move at least one approach to a region because we cannot examine it. This is not really a solution, but only a “postponement”. However, the DP urgently requires this approach.

6.1.6 Termination of recursion

Of course, we cannot stop at 4D either. Mathematically, recursion can go on forever. How many spatial dimensions would there be then? I don’t know.

But we can make an estimate. If we want to have a QFT mapping from an n-dimensional spacetime to an (n-1)-dimensional spacetime, then the spacetime density in the n-dimensional spacetime must not be a black hole. It follows that the total spacetime density of our 3D spacetime in 4D is not sufficient for a black hole (further argumentation in the next section on the big bang). We must be a quantum of space-time in 4D and not a collection of quanta. Our space-time started as a single space-time density.

In our space-time, the Planck mass is the criterion for a black hole. The simplest 2D representation of a black hole is an electron (Planck mass in 2D). The difference between 3D and 2D is already about 10^{22}. The universe has a total mass of about 10^{57} kg. The Planck mass in our space-time is only 10^{-8} kg. The difference from 3D to 4D must therefore be at least about 10^{65}. This value increases extremely quickly with each spatial dimension in a spacetime. If there is no longer enough spacetime density in a spacetime to map the Planck mass, the recursion breaks off. I don’t think we’ll get out of the single-digit range of spatial dimensions.

6.2 Big Bang

We have gathered enough to almost be able to resolve the big bang. We can’t quite do it because we have to “shift” into the realm of unsatisfactory solutions. We will need 4D here. We want to describe a big bang in a 3D space-time. We will see that a big bang has a lot to do with QFT.

The big bang from the textbook has three fundamental problems.

- We start with a space-time at Planck length and extremely high energy. The actual process of creation of the starting point or space-time is missing. Where does the Planck-sized space-time, energy, fields, etc. come from?
- The Big Bang is said to have started from a fluctuation. We will omit the discussion here of which field it should have been. Some kind of fluctuation is needed. Where should that come from if we cannot yet define the passage of time? Fluctuation without a definition of time and space?
- If a fluctuation in a field of QFT is supposed to have triggered the expansion of space-time, then this field must couple with space-time in some form. A field can fluctuate as it wants, space-time begins to expand. There must be a coupling. What does it look like?

There is no answer to any of these questions in the textbook. The development of the universe is simply (much too simply here) traced back to the Planck time and Planck length. Spacetime, energy in spacetime, fields, fluctuations, coupling of fields with spacetime, etc. must then simply be present. We do not want to start our universe that way.

6.2.1 What is not possible

Let’s try everything we have so far:

- 0-space dimensions do not exist
- 1-space dimension has no mapping
- 2-space dimensions are static, so no fluctuation or initial ignition is possible

In fact, we also have to start with 3 space dimensions for the big bang. However, we are dealing with only 3 space dimensions in the DP just like in textbook physics. We cannot clarify the 3 questions again. For this, 3D space-time is simply not enough. The textbook covers a variety of fields. We have to switch to something else. Unfortunately, there is only one option left. The unsatisfactory 4D solution. Let’s try to solve the 3 questions.

6.2.2 QFT for 4D space-time as an evolutionary process

As always, the DP points us in the right direction, since there are almost no options. To get a space-time density in n-dimensional space-time, there must simply be a space-time density in (n+1)-dimensional space-time. Since the space-time density represents the space-time itself, this “low-dimensional mapping” is a real generation of the space-time.

This makes it clear:

The big bang is a mapping of a 4D space-time density as a local QFT onto a 3D possibility.

I know that’s not very spectacular for a big bang. But within DP, this is the only possibility we have.

When we look at our body, we could see ourselves as almost divine beings. Every single elementary particle of our body, and there are a hell of a lot of them, has an infinite number of images in lower-dimensional spacetimes. We are made up of an infinite number of 2D and 1D spacetimes with black holes. Just wow! Now comes the damper. From the point of view of a 4D spacetime, we are what? The best description is probably “nothing”. Our universe as a whole is just an arbitrary space-time density in this sense. Whether there are also elementary particles etc. in this realm, I have no idea. As I said, I stop right there. The QFT in 4D must be solved by smarter people. Only a black hole in our space-time creates an effect in 4D again. Everything else is not relevant for 4D.

What we can do is exclude an important mapping. We cannot be a black hole in 4D. Otherwise, there would be no low-dimensional mapping for this space-time density. Since our universe exists, this is out of the question. The same argument also applies to the recurring idea that our universe is a 3D black hole and we are at the center of the black hole. Even then, the space-time density should not have a low-dimensional image. However, I am quite sure that we are subject to QFT in my environment.

Sorry that the big bang is so simple. We can now state exactly what the big bang is in our space-time. But we have not solved the basic problem. It was simply moved from 3D to 4D. Then where does the spacetime density in 4D come from? I have no idea. I can't even say whether we are just a possibility in 4D or whether we count as something real in a measurement there. I admit, this solution is very unsatisfactory. But it's the only one we have.

6.2.3 Fluctuation at Plank length and Planck time

For the "starting condition" of the Big Bang, the textbook assumes the Planck length and Planck time. But why? Presumably, it is assumed that there is no smaller length or time in our universe. If the size of the universe is calculated back, you have to stop here at the latest. Are the Planck length and Planck time really good assumptions for the starting condition of the universe? Not for the DP. There are two reasons for this:

- At these sizes, it is no longer possible to have a fluctuation in the DP. So the desired spark from the textbooks cannot have existed.
- We can do a small calculation for the starting size

6.2.3.1 Planck length and Planck time as lower limit

Like the GR, we assume continuous space-time. There must be no smallest values for time or length. Otherwise, we would not have a continuum. Where does this lower limit come from?

In DP, the Planck length or Planck time has no relevance on its own. These are the values that we use for c, d and h. However, these values always occur in a combination. This combination of values is crucial. Thus, these are not the smallest units of space or time.

Where the DP and the textbook approach are identical, the Planck length and Planck time are the smallest barrier for an interaction. If you want to have a limited interaction in these areas, then so much energy is needed that the value of *d* is exceeded and it goes into a black hole. Both theories agree that there must be no interaction whatsoever in this area.

For now, let's disregard the origin of space-time and fields from the textbook approach in the big bang. We want to let the big bang arise from a fluctuation, symmetry break or similar, as desired, but this is not possible at the Planck scale. At this level, space and time are not defined. How should an interaction take place in space and time?

I understand that we need a lower limit and that we have drawn one for lack of a better one. Sorry, that just doesn't make sense. Can we specify something better in the DP?

6.2.3.2 Initial size of the universe

We cannot calculate the starting size exactly. However, we can make an estimate again. Our approach for the calculation is d, the dimensional constant. We are sure that our universe did not start as a black hole. Then the space-time density must not have been too large. This allows us to specify a minimum size for the distribution of energy during the Big Bang, which must not be exceeded. We make the calculation a little easier and not 100% exact, since it is only an estimate. We take the reciprocal value of d, then it is a little more obvious.

$$\frac{E_P}{l_P} > \frac{E_V}{l_{searched}} \rightarrow l_{searched} > E_V * d$$

We assume that the reciprocal value of d must always be greater than the right-hand side. If the fraction on the right-hand side is greater than or equal to the left-hand side, a black hole should be formed. Then insert everything:

Energy in vacuum approx. : $7.67 * \ 10^{-1} \ \ Joule/m^3$

d : $8.26 * \ 10^{-45}$

$l_{searched} \ > 6.338 * \ 10^{-54}$

Oops! That's smaller than the Planck length. We also simply applied the energy from a volume to a length. We have to do the size estimation per space dimension. Our entire spacetime starts small.

$$l_{searched} \ > \sqrt[3]{6.338 * \ 10^{-54}} \rightarrow l_{searched} \ > 1.85 * \ 10^{-18} \ Meter$$

This is still very small as a lower limit. A proton is about 1000 times larger. However, the starting point is at least 17 orders of magnitude away from the Planck length.

6.2.4 Coupling of fields and space-time

For me, this is one of the most important topics in cosmology. This is also a reason for assuming the DP with the space-time density and the space-time boundaries. How can the fluctuation or the symmetry break of a field of the QFT influence space-time?

Space-time (or just space) expands. What about the fields? Do they cause space-time to expand? If so, then there must be a coupling. If not, then these fields must not expand with space-time? Were they already present at the infinite before? Then the big bang only affects space-time and not QFT fields? If field fluctuations in space-time should trigger something, then there must be a coupling.

We can ask questions ad infinitum, but it always comes back to the fact that the fields of QFT must couple to spacetime. Otherwise, these fields would simply not trigger anything. I have never seen a description of this. It's a huge gap in QFT, but it's not being worked on.

In the DP, we have an easy time of it. All fields of QFT are low-dimensional spacetime configurations. Low-dimensional spacetimes arise only with the mapping of the spacetime density from the higher-dimensional spacetime. These fields were not there before the Big Bang. Therefore, it cannot have been a fluctuation for us.

From the boundaries of space-time, it follows that geometric concepts such as size, length, etc. do not exist between 2D and 3D. Whether 3D space-time expands is completely irrelevant to a 2D space-time. The coupling we know are the particles of the standard model. This is the only possible mapping of the space-time density across the boundary. An electron shortly after the Big Bang, shortly before the speed of light or on its way into the center of a black hole is always an identical electron. The electron does not care what drives space-time. It must only be the mapping of a space-time density.

In DP, the QFT mapping for the big bang is not relevant for our 3D space-time in the first step. However, the big bang is a 4D QFT mapping in 3D. This is how space-time is actually created. Our entire universe is probably a 4D elementary particle.

The dimensional transition via space-time density is the only coupling of the different space-times to each other.

6.3 Why expansion?

Let us now turn to **the fundamental question of cosmology**. Why is the universe expanding and what is actually expanding?

Don't give me: "The Friedmann equations from the GTR determine that there is a scale factor for space (not space-time). Therefore, the universe must expand." No, no and no again. Mathematics describes nature. Mathematics is not a "force" of nature that can produce an effect. If such a statement is made on the basis of a description, then there must be a physical reason for it. This is built into the mathematical model.

What is the reason? The answer in textbook physics is very simple: it is not known. Unfortunately, this answer is given too rarely. The mathematics of general relativity is always used to argue. Dark energy is only there for later exponential growth. For the first few billion years, let's say, it played no role in the expansion. We need an immediate expansion with and after inflation. Yes, exactly, we still need inflation so that the observations fit together. Then dark matter and dark energy are added, etc.

The observation of the expansion and the scale factor from the Friedmann equations fit together so nicely that the whole of cosmology has been built on them. We already have the Big Bang, so the rest could be identical. We will show that the descriptions, from a certain point of view, are almost identical. However, we will use completely different foundations in the DP.

For this reason, we will make a change in the structure of the text. Until now, we had first or simultaneously built up the classical view from the textbook together with the DP. Then the comparison is easier. This no longer works here. We will first build the cosmology from the DP's point of view. Later we will compare it with the classical view. The approaches are too different. Thus, the basis of the cosmology, from the point of view of the DP, will seem a bit strange to professionals in cosmology. Example: In the DP, space-time changes and not just space. We will see that this is also the case with the Friedmann equations. It is just very well hidden. For the full picture of cosmology, Chapter 6 must therefore be worked through completely in the given order. The reference to textbook physics comes only at the end.

6.4 Expansion of space-time

Let us ask again: Why is space-time expanding? This question can be answered very easily in DP. Simply because of the existence of space-time.

- Every point in space-time has a space-time density
- Space-time density is energy, geometry and state of motion in one. This is an identical property with different descriptions.
- No particle is required for a movement. Even a point in space-time in a vacuum must have a state of motion.
- Thus, all points in space-time must have a state of motion in relation to each other. The distance must increase or decrease.
- This state of motion must not have an outstanding direction. It must be a state of motion in all directions at the same time.
- A simultaneous movement of spacetime itself in all directions corresponds to space-time expansion. A point in space-time has a "scalar" movement.

From the chosen approach, it follows that space-time can never be a static structure in itself. We do not need to look for the why. It is the other way around: without a space-time expansion or compression, the approach of the DP makes no sense.

6.4.1 Known changes in spacetime components

If a spacetime point is a state of motion, then it is not yet clear how or whether the spacetime components must deform. So far, we have two deformations for the spacetime density and one for the spacetime curvature:

- For a rest mass, there must be a scalar spacetime density. First part of the energy.
- For the momentum, there must be a vectorial space-time density. Second part of the energy.
- For the continuum of space-time, the space-time curvature must balance the space-time density. No change in energy in space-time.

Let's look at the options available to see if we can use them for the expansion.

6.4.1.1 Scalar space-time density for particles

A scalar space-time density sounds very good. This is exactly what we are looking for in terms of expansion. However, we have a problem here. This scalar space-time density for a mass-energy equivalent is defined by the fact that the energy is higher than in the surrounding area. This means that the time and space components become shorter to an identical extent. The length definition becomes smaller. We need an increase, which is the observation. This makes it clear that it is not that wrong. Only the direction is wrong. This means that expansion could be the opposite. An increase in the definition of time and length.

But the next question arises immediately. If a spacetime density must necessarily expand in a scalar manner, why does a mass-energy equivalent not do the same? In principle, there is no difference between an elementary particle and the complete space-time in the big bang, as a space-time density. But the elementary particle does not expand. We are very sure about that. What is the difference? Fortunately, there is a killjoy and an exception. In this section, we will only deal with the killjoy.

The killjoy is QFT. Every space-time density from 3D has a low-dimensional mapping. This mapping, across the dimensional boundary, knows no geometric information such as "size". The mapping in QFT is, seen in 3D, actually something like a point size. The 3D space-time is now no longer independent. It can no longer change the space-time components as long as the QFT has a fixed mapping. We absolutely need an interaction so that the mappings of space-time can be distributed differently in QFT. Without it, everything remains fixed. Space-time as a whole has no mapping in QFT in 2D. At most, there is the particle zoo from the standard model. With that, space-time must "decay" and expand.

6.4.1.2 Vectorial space-time density for particles

This is like the previous one, only the space-time density is mapped onto a specific spatial dimension (direction). The big difference is that the momentum is a mapping in 3D. This is explicitly not protected by the mapping in QFT. We see this behavior, for example, in neutrinos. These particles are stable and were produced in large quantities in the early phase of the universe. The neutrinos as such are still measurable today. The momentum of these neutrinos has decreased due to the expansion.

Here is another remark about motion. The momentum is explicitly a vectorial spacetime density. Only this can be perceived as motion in spacetime itself. In order to perceive a particle, we first need the scalar spacetime density. The motion of the particle is then the vectorial spacetime density. Therefore, the expansion must be a scalar spacetime density. Nothing moves in spacetime.

The vectorial space-time density is the same as the scalar space-time density for expansion in the opposite case. The opposite case of an impulse is a negative impulse. Should expansion then be a braking? A loss of energy for space-time? You see, it remains exciting. The resolution will come in this chapter.

6.4.1.3 Space-time curvature

In the case of space-time curvature, the length definition increases and the time definition decreases. The greater length looks good at first. Why not gravity? The changes in the components of gravity are out of the question for two reasons.

Space-time curvature is not a reaction of space-time on itself. For space-time curvature, we absolutely need different space-time densities. This is what gravity reacts to. If you will, space-time curvature is a passive reaction. An imbalance must first be created, for example by QFT. In the direct mapping from 4D to 3D, there is no reason to assume that space-time was not perfectly homogeneous. 4D would not recognize any fluctuation in 3D. Right at the Big Bang, the space-time curvature in our space-time should have been zero. Therefore, no expansion results from gravity.

We can exclude the second reason on the basis of observations. Gravity is always directed towards a center and decreases with distance. According to observations, we need an expansion that is almost identical everywhere in the universe. This cannot be done with any interaction whose effect depends on a range.

6.4.2 New changes in the space-time components

How would we have come to a similar result if we had looked at the possible changes in the space-time components in an overview? There are only time and space components. These can only increase and decrease. The number of possible combinations is small. We expand the first overview of the deformations:

Figure 33

deformation	**deformation**
space-time curvature/gravitation • **time dilation** • **length relaxation** • **inhomogeneous**	**space-time density** • **time dilation** • **Längenkontraktion** • **homogeneous**
antigravity • **time relaxation** • **length contraction** • **inhomogeneous**	**expansion** • **time relaxation** • **length relaxation** • **homogeneous**

Figure 33 shows the possible deformations of space-time

We have the known deformations. But there may also be a counterpart to each of these. In physics, the counterpart is often called “anti”. Therefore, we call the counterpart to gravity: antigravity and the counterpart to spacetime density: expansion. Please do not call it anti-spacetime density.

We do not allow a certain type of combination. If there is a change in a spatial component, then also in the time component and vice versa. We do not allow the possibility of a change in the spatial component without a change in the time component or vice versa. Changing the definition of length is always a step towards or away from the space-time boundary. Since time is the measure of distance to the space-time boundary, within the DP a change in space and time always works together. If we have learned anything from the SRT and the ART, it is that space-time is to be regarded as a single substance. The components change together with the same strength or not at all. An expansion that only includes space but not time is not possible for us. This is where we once again oppose the current doctrine of expansion. The resolution comes later and is surprisingly simple.

What we can easily see in this diagram is that gravity is not the counterpart of expansion. This is often explained incorrectly. Gravity only ensures the continuum in space-time. Gravity does not care about expansion or shrinking. It only reacts to the fluctuations of the density of space-time. But it does not explicitly change the density of space-time.

This makes it clear what increases with expansion. The length and time definition becomes larger. Even with expansion, there is no squeezing or pulling. At each point in space-time, the length and time definition is increased. This leads to the larger distances. We cannot recognize the change in the time definition, since this does not add up over a distance. We do that at the end when comparing with textbook physics.

But wait a minute. If this happens identically everywhere in the universe, I wouldn’t be able to detect this increase at all. Almost right. But the elementary particles that everything is made of don’t go along with this. QFT doesn’t allow it. Thus, space-time always gets larger in relation to an object. In addition, we measure this from within a gravitational field. Although gravity is not the counterpart, it does put resistance to the expansion. The expansion wants to have a larger time definition, gravity a smaller one. Space-time with gravity increases the resistance to expansion.

6.5 The course of the expansion

We now have all the pieces together to describe the course of the expansion. In doing so, we will find that a form of matter must explicitly form, dark matter. This only forms when space-time behaves in a certain way, when there is inflation. Since dark matter is created, inflation in the DP looks different than in textbook physics.

6.5.1 Big Bang as starting point

We already had that. A space-time density from 4D is mapped into our space-time. This is how our space-time is created. The space-time density is completely homogeneous. The figure is below the dimensional constant, otherwise a black hole would form. We have already made an estimate for the size. Nevertheless, space-time starts with an extremely high space-time density. Then space-time expansion sets in. The QFT actually takes some time. Thus the expansion starts before the QFT.

6.5.2 Inflation

At the beginning of the expansion, inflation is mandatory in the DP. There is no additional field, there is no fluctuation, there is no symmetry breaking, there is no... (think of any name, it has probably existed before). Nevertheless, there is an exponential growth of the length definition. The solution is very simple. Let’s look at the graphic.

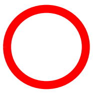


Figure 34

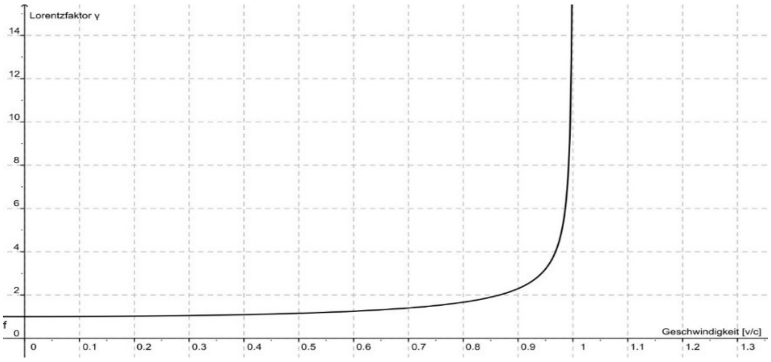


Figure 34 shows the Lorentz factor. This determines length contraction and time dilation as an exponential function. The horizontal axis is the speed and the vertical axis is the Lorentz factor.
Wikipedia: Von Klamann – Eigenes Werk, Gemeinfrei, https://commons.wikimedia.org/w/index.php?curid=6755675

This is the illustration of length contraction and time dilation (Lorentz factor) from the SR. That's exactly what it's about. We just have to reverse the direction. We need a time and length relaxation. The big bang is the starting point. That's the red circle. Somewhere very far up. Whether a 3D spacetime starts with an inflationary phase depends only on the amount of spacetime density that is mapped by 4D.

We also don't need another "vacuum condition" for inflation to stop again. This all happens automatically here. The entire process of inflation is already included in GR. Inflation itself is a different process here than in textbook physics. Contrary to textbook physics, we don't need inflation to solve certain problems. Flatness of space-time, horizon problem, etc. We don't have these problems at all with the starting condition of homogeneous space-time density. But inflation is still there and cannot be avoided in a 3D space-time with so much space-time density.

6.5.3 Dark matter

During inflation, something happens that I mistakenly saw in an old version of the DP within a black hole. Black holes are created. Not just any black holes, but the smallest possible black holes. But one step at a time.

6.5.3.1 Spacetime is a field of potential

Space-time expands. This means that there is a change in energy for space-time. Space-time "thins out". According to our logic, this is less energy. Nothing changes for space-time itself. One meter remains one meter, because the definition changes. It follows that locally there is no change in energy for space-time. You simply have to distribute the energy over a larger volume. The content is diluted, the total amount does not change. This means that energy conservation follows from DP for the whole space-time with expansion. The space-time density only changes.

An elementary particle will not be able to withstand the extreme dilution in the inflation phase due to QFT. Then the energy of the particle will increase exponentially. This is the same as with gravity. No interaction from the outside, but still a change. In the case of gravitation, this is due to the opposing deformation of space and time. Thus, without a change in the conditions of energy. Here, however, space and time increase uniformly. The elementary particle gains energy because the valency of the space-time density of the elementary particle changes in relation to its environment. We have called this a potential field. Here, it is directly related to energy.

Space-time is a potential field for energy.

6.5.3.2 More energy up to the black hole

This means that every elementary particle in the inflation phase that does not decay quickly enough receives an exponential increase in energy. But this is only possible up to the dimensional constant. Then a black hole forms, with the exact Planck mass. This gives us the smallest possible black hole that can form in our space-time. Once the exponential growth of the length definition is over, this can no longer happen.

If space-time is a field of potential, black holes must necessarily form from the first elementary particles in combination with inflation.

6.5.3.3 Dark Matter = Black Holes

These smallest black holes have a very special property. The cross section is close to zero. With a little calculation, you quickly come to the conclusion that a black hole with the Planck mass has a Schwarzschild radius of 2 Planck lengths. That's damn small. It is so small that absolutely no particle from the standard model fits into the black hole in one piece. If such a black hole wants to eat, it has to get an elementary particle in as a quantum (in one piece). These are black hole corpses. They can't do anything with matter. So these black holes remain what they are from the moment they are created. These black holes thus have the following properties:

- They are present from the beginning
- They cannot change over time
- They only interact via gravity
- Show absolutely no signature other than gravity
    - There is no annihilation or similar. Even Hawking radiation would not work here, because for that the black hole must be able to eat a particle.
    - Even if two of these black holes merge, no radiation can be detected.
- The effect never decreases. Even after a merger, the gravitational effect has not diminished.

This means that these black holes in the DP are dark matter. Again, no new elementary particles or fields. The formation of dark matter is necessarily foreseen in the process.

The dark matter no longer have a QFT representation as black holes. However, these are not enlarged by the expansion. Gravity is a resistance to expansion. This resistance is not very high at a Planck mass. However, dark matter also occupies a very small region of space. There, the effect of expansion is very small.

6.5.3.4 Black holes at the beginning of space-time

This tiny cross-section only plays a role between black holes. In the early universe, there is a higher probability that dark matter will clump together. Two black holes merge into one black hole with twice the mass. This gives us the possibility in the DP that there are black hole seeds very early on. It should therefore come as no surprise if a JWST finds more and larger black holes than the standard model allows. We don't have to wait for star formation and collapse.

6.5.4 The kink in the diagram

As can be seen from the diagram, inflation does not stop abruptly; it decays. Not linearly slowly, but still quickly. However, this has the effect that the elementary particles at this time have a greater momentum than assumed by the standard model. The rarefaction of spacetime to the spacetime density of a particle can also show up in momentum. For a black hole, it is no longer sufficient, but for a larger momentum it is. However, momentum is the "antagonist" of gravity. In exactly the other direction, it follows that momentum from an interaction in an early universe is no longer of much value. It follows that when calculating how clumped the universe is due to gravity, there are two errors here:

- The universe must not be as lumpy in total as the standard model predicts. Free particles can be captured less by gravity.
- The individual objects, e.g. a black hole, must be larger than predicted. Within a gravitational field, the first point is much less relevant.

This means that you cannot simply calculate it back linearly. This is much more complicated.

6.5.4 The long straight line

The long straight line after the kink is the most boring part of the development. Don't forget to read the diagram from right to left. Here everything goes as described in the textbook. The approximately 14 billion years of space-time lie almost completely on this straight line. Inflation and the kink have an enormous effect, but in terms of time they are the smallest part. From the straight line on, the expansion rate can be considered almost constant.

According to the theory, the expansion should decrease more and more from the past towards the future. However, observations show the opposite. The culprit is quickly found here. If it is not spacetime itself, then it is the QFT. In textbook physics, the vacuum is identified as the driver of expansion through quantum fluctuations. In our approach, QFT does exactly the opposite. It prevents a spacetime density from expanding. In our approach, the vacuum is also a spacetime density and therefore has energy. This must also be mapped in QFT. This is how the quantum fluctuation in the vacuum arises. No negative energy has to be borrowed for pair formation. Spacetime corresponds to energy. Thus, energy is always present.

But the energy is thinning out. Less energy, in connection with the QFT, means less "braking power" against expansion. At the time when the background radiation was formed, the QFT was still able to slow down the expansion of space quite well. Therefore, the expansion rate was lower there. This means that the expansion rate is higher today. On the straight line, the braking effect of QFT is more important than in the early phases. This is the reason for the different observations of the expansion rate.

What we don't have is dark energy. This is not needed in DP.

6.6 Measuring the expansion

The expansion is measured mainly by the redshift of photons. This should not be possible with our logic. The QFT prevents an expansion of the space-time density. I have called QFT a killjoy. I also mentioned that there is an exception. The exception is the photon. If it weren't for this exception, we wouldn't be able to observe an expanding universe.

The photon has no rest mass and therefore explicitly cannot have a QFT picture as a black hole. A photon is an extrinsic expression of a 2D space-time in 3D. There is no expression in 2D itself. If we stick to the wave picture of the photon, then the wavelength is given in 3D and not in 2D. This results in the higher space-time density in 3D and cannot be captured by QFT.

Therefore, the redshift, as an increase in wavelength, is directly the space-time expansion. This redshift is not an effect of objects moving apart. This is the expansion itself.

6.7 Cosmological constant

We urgently need to look at the mathematics of GR here. So far, we have used the field equation in this form:

$$\boldsymbol{G_{\mu\nu} = k * T_{\mu\nu}}$$

The Einstein tensor indicates the curvature of space and the energy-momentum tensor indicates the source. The energy-momentum tensor is the collection of all the different mass-energy equivalents. However, a part is missing from the collection of mass-energy equivalents. More precisely, the largest part of the energy in the universe. The spacetime itself, the vacuum. In a vacuum, the energy-momentum tensor is zero. But that does not correspond to our idea. Every point in spacetime is an energy greater than zero. So we have to include an equally distributed variable in the equation for the vacuum. The mathematically simplest thing is a constant for the metric. In fact, this is one of the few changes in the field equation that does not destroy the structure behind the field equation.

We have to take the field equation with the cosmological constant. The formula then looks like this:

$$\boldsymbol{G_{\mu\nu} = k * T_{\mu\nu} - \Lambda g_{\mu\nu}}$$

I write the cosmological constant on the side of the energy-momentum tensor, since this is an energy contribution. The cosmological constant is simply a scale factor on the space-time metric. This fits with our explanation. Space-time experiences a relaxation of length and time to the same extent. This is simply a constant number. The sign must be different from that of the energy-momentum tensor. This part of the energy produces a “negative” energy contribution. A larger spacetime density is a plus and a smaller one is then a minus.

6.8 Comparison with textbook physics

There are many more aspects to cosmology than are listed in this chapter. However, we have to limit ourselves somewhere. As a final part on cosmology and also part 2, we want to compare the view of DP and textbook physics.

Here we will only compare the view from the Friedmann equations for DP. Anything else would mean a very long text. We will see that there are actually only very slight differences. We have to get to the bottom of the question and assumption behind the Friedmann equation. Then we get something similar to the SRT. Although the space-time density does not appear compatible with the SRT, we get the same results.

6.8.1 Homogeneous and Isotropic = Spacetime Densi

The first step to the Friedmann equations is the assumption that the universe is homogeneous and isotropic. Observation of our immediate surroundings, e.g. the home galaxy, indicates the opposite. Therefore, in the assumption that this is valid for large scales in the universe. This is not the case. According to the energy-momentum tensor, the mass distribution is completely homogeneous, without any grain. This leads us to two points.

- The universe corresponds to a spacetime density. This is always homogeneous and isotropic for us. The starting conditions in the DP and textbook physics are identica.
- The energy-momentum tensor has the signature ($-c^2\rho, p, p, p$). All other values are zero.

These two points have several implications.

Homogeneous and isotropic enters the signature as 100% homogeneous and isotropic. This means that there are no distinguishable mass-energy equivalents in this approach. The universe is regarded as a single large mass-energy equivalent. A “granularity” no matter how fine or coarse is not intended. Thus, the mass density $c^2\rho$ in the 00 element of the energy-momentum tensor is a real continuum. This is a very good description of an energy density. Full agreement.

Since the energy density in the 00 element cannot show any fluctuation, there can be no gravity from the point of view of DP. In textbook physics, the reaction to the energy density is also seen as gravity. But then a repulsive one. We do not classify this as gravity, but as expansion. The deformations of the space-time components are different. Except for the naming, however, there is also agreement.

6.8.2 Where does the pressure come from?

The big sticking point is the pressure on the 11, 22 and 33 elements. Let me ask a simple question about this. Where should this pressure come from? The textbook has a simple answer: thermodynamics. There are particles in the universe that interact and that creates pressure. In principle, it is assumed that the energy density of a mass distribution corresponds to that of dust. The individual particles then participate in the thermodynamics. The mass distribution behaves like a liquid. There is always pressure in it. The entire assumption for the pressure is based on the fact that mass is present in point-like particles. We don't know it any other way. These particles have an impulse and thus they generate a pressure. A pressure on what? Mass with impulse generates a pressure on space-time? Then we have the discussion with the coupling to space-time on our backs again. If we assume individual particles, then this should also be included in the energy density. But that is a pure continuum. The pressure does not match the energy distribution.

The whole thing means that two assumptions are included in the energy-momentum tensor. A homogeneous and isotropic distribution of the energy density and a pressure of the particles on themselves. The granularity for the pressure is not included in the energy density. The pressure lies on the 11, 22 and 33 elements. This is not a pressure like an impulse in a certain direction. I would see this as a self-fulfilling prophecy. We put in a "scalar" pressure and get a "scalar" reaction of space-time to it.

In DP, this pressure arises due to length and time relaxation. This is a "negative" energy for the energy distribution. The signs of energy density and pressure must be different. According to the deformations of the space-time components, these are each the counterpart of the other. The cosmological constant is the behavior of the metric. The pressure is the corresponding energy value for it.

We can thus conclude that the DP enables the assumptions for the Friedmann equations better and more simply than textbook physics can.

6.8.3 Scale factor for space or space-time

There is still a major difference to be discussed here. From the Friedmann equations, one obtains a scale factor for space and not for space-time. In the DP, however, we always assume a change in space-time. Space as an independent object no longer exists there. What is the difference here? Simple answer: there is no difference.

In the Friedmann equation, the time component also changes. This is best seen when the energy-momentum tensor with the signature is inserted into the equation. We obtain a term in the Einstein tensor for the 00 or better tt component of the energy-momentum tensor. It looks like this:

$$\frac{\dot{R}^2}{R^2} + \frac{k}{R^2} = \frac{8\pi G}{3}\rho$$

The time component has an active effect. The problem with this is that we cannot recognize the effect on time at all with the given question and assumption of a homogeneous and isotropic universe. The following picture:

Figure 35

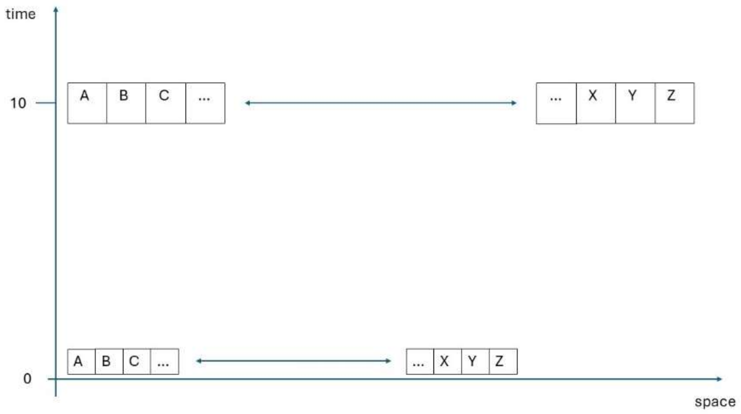


Figure 35 shows the development of a distance over time

We are at point A and measure a distance to point Z. The rest of the alphabet lies as points in the distance. At time t = 0 we have a fixed distance R between A and Z. We make a new measurement at t = 10. As a function R (10), since the distance must depend on the time.

Each letter on the route has now increased by x. This applies equally to each letter, since we are assuming a continuum. If we now want to determine the distance, the change is added up over the distance. The further away the letter is, the greater the distance has become. We see this in the expansion of the universe.

Due to the continuum, time also accelerates for each letter along the way. Time relaxation is a faster passage of time. This means that the passage of time is identical in each letter. There is no difference in the passage of time from one letter to the next. The crucial point, however, is that we want to query the new distance at point A for R(10). The change has already been incorporated into the time parameter 10. These are no longer the identical 10 seconds as at t = 0. We just can’t determine that. The time definition has changed. 10 time units are 10 time units for each letter on the route.

The change in distance adds up in time. The change in time is already included in the question and does not add up. Of course, space-time is always adjusted in the Friedmann equation as well. We just can’t determine it.

6.9 Conclusion Part 2

That was a lot of work so far. The basic idea behind DP and how it can be applied in physics should now be clear. Certainly not all questions about DP or the interaction with SR and GR have been answered. If you still have questions, please use the contact form on the page.

But we still have a big piece missing, Part 3 the QFT. This part is currently February 2025 not yet completed in a new version. I’m working on it. Since QFT is quite a bit more complicated than GR, it will take some time. I don’t want to provide the QFT from an old version because some things have changed that are no longer correct in the old version. If you want to be informed when it is available, enter the text “Abo” in the contact form. Then you will receive an email when I have finished a new part. This will probably take 4-5 updates.

Until then, have fun with the DP and your own thoughts on it, which I hope you will share with me.

Christian Kosmak, Würzburg, Germany February 2025

www.dimensionale-physik.de