Chapter 1 Introduction to Field-Space-Mechanics

"The basis of knowledge is doubt about all knowledge" - René Descartes

1.1 Observable Theory of Relativity - The extension of the reference system

The aim of this chapter is to recognise that the existing model of the general theory of relativity (GTR) must be extended in order to gain further information about the previously hidden causes of various space-time mechanical effects and to make these relativistically calculable. The elaboration of the special theory of relativity (STR) for 3-dimensional space, which will be generalised in the course of the following chapters, will serve as a starting point. Einstein's core statement is that an object of mass or energy bends space-time. Objects take the courses of a space-time curvature, which leads to the formulation of the law of gravity. GTR assumes that a perfectly self-contained inertial system can only change its direction or speed due to its inertia if an external force acts on it. A body with a mass M is therefore accelerated within the sphere of influence of a gravitational field. Furthermore, the theory assumes that the **maximum velocity V_{max}** in a vacuum has the same value of

$$V_{max} = 299792458 \, \frac{\text{m}}{\text{s}} = c.$$

As a result, space and time can change dynamically in relation to the maximum speed $V_{max} = c$ and an object can only reach this speed asymptotically. Light propagates in a gravitational field along a curved path. This is dependent on the observer relative to moving objects.

The assumptions from GTR are:

Equivalence principle: The force of gravity is identical to the force of inertia in an accelerated reference system.

Gravitational red shift: The wavelength of light propagating against a gravitational field increases.

Gravitational blue shift: The wavelength of light travelling towards a gravitational field decreases.

Reference system: The spatiotemporal behaviour of an object can be clearly described using a reference system, such as the Cartesian coordinate system, with its location-dependent variables.

Inertial system: A reference system is an inertial system if a body remains at rest or moves uniformly relative to the reference frame. To achieve this state, an object must be free of other forces.

Mach's principle: Mach's principle: States that the universe does not generate any additional space-time deformation for local objects. Taking Mach's principle into account, this means that there is no global dilation effect on the speed of light. As observed in countless experiments, the speed of light is equated with the maximum speed $V_{max} = c$.

Measuring principle of light via resonator mirrors: A light wave has a certain distance between two mirrors for a travelling and returning wavelength, which fulfils a resonance condition *with* $n \frac{\lambda}{2} = l$. *n* stands for an integer multiple of the wavelength of the light. The distance between the resonator mirrors is the distance *l*. The area between two resonance areas contains the entire spectrum of the light and is defined as *FSR* - free spectral range. With constant repetition of the wave movement per second, a frequency *f* is created. The speed of light can be represented by the product of the free spectral range and the distance between the resonators:

$$c = FSR \cdot 2l \tag{1.01}$$

In order to carry out a measurement, a setup is realised in a vacuum environment using a light-emitting diode as a transmitter and a photodiode as a receiver. The path of a light wave is adjusted by several mirrors and distances from each other. If an emitted wavelength hits the photodiode at a certain distance *s*, an alternating voltage is recorded. The phase position for two received wavelengths can be determined between two differently set distances. Two different propagation times with the same frequency are recorded using an oscilloscope. The path length *s* between two wavelengths is shifted with an adjustment of Δl so that a phase position of π is measured. The transit time difference must be calculated as

$$\Delta t = \frac{1}{2}\frac{1}{f}\,. \tag{1.02}$$

The speed of light *c* is finally calculated as

$$c = \frac{\Delta l}{\Delta t}\,. \tag{1.03}$$

The Technical University of Munich uses this principle to carry out its light measurements as part of its experimental physics programme.

To begin with, the deformation of space-time will be described in terms of velocity states, which corresponds to the special case. These velocities are a snapshot of the state of motion that occurs in an accelerated space-time under gravity. With the dynamic temporal change of the velocities to a relativistic acceleration-behaviour, the special consideration is raised to the general theory of relativity.

The **Minkowski metric** of the four-digit tensor in 3-dimensional space from the STR is as follows:

$$-\frac{dx^2}{dt^2} - \frac{dy^2}{dt^2} - \frac{dz^2}{dt^2} + c^2 = \frac{ds^2}{dt^2} \qquad (1.04)$$

The term $\left[-\frac{dx^2}{dt^2} - \frac{dy^2}{dt^2} - \frac{dz^2}{dt^2} \right]$ corresponds to a vectorial quadratic object velocity in 3-dimensional space in the form of a differential geometry.

$[c^2]$ is the maximum square velocity V_{max}^2 for objects and is also the reference value for a non-deformed space at rest.

The term $\left[\frac{ds^2}{dt^2} \right]$ describes the behaviour of light within a deformed space, which is registered by an external observer.

With this metric, STR is able to calculate a space-time curvature caused by a gravitational field that exerts a force on an object. In other words, a moving object mass additionally curves space-time at its location in addition to its rest mass. The reasons why a moving object in a vacuum additionally curves space or how a gravitational field arises are not initially answered by the classical approach.

The following three phenomena from STR go back to the transformations by H. A. Lorentz:

1) Time runs slower for objects under the influence of speed. This phenomenon is known as time dilation.

$$t_{obj} = t \frac{c}{\sqrt{c^2 - V_{obj}^2}} \qquad (1.05)$$

t	- time elapsing for a non-deformed space-time
t_{obj}	- object time in a deformed space-time
c	- maximum speed $V_{max} = c$
V_{obj}	- resulting velocity vector in the 3-dimensional space

2) Objects shrink under the influence of speed in the direction of movement. This phenomenon is known as length contraction .

$$x' = x \frac{\sqrt{c^2 - V_{obj}^2}}{c} \qquad (1.06)$$

x - space segment without deformation
x' - deformed space segment

3) Objects become heavier when energy is added. This effect is known as relativistic mass increase.

$$E = m\, c^2 \frac{c}{\sqrt{c^2 - V_{obj}^2}} \qquad (1.07)$$

E - energy
m - object mass

Point 3) states that an energy-mass equivalence applies to a moving object. Objects, that are already accelerating or under the influence of gravity, are only further accelerated by the addition of kinetic energy. The Field-Space Mechanics (FSM) model will demonstrate that a deformation of space-time also occurs as a result of potential energy.

If the term "velocity" is replaced by "acceleration and increasing gravity", then these relationships are formulated in general relativistic terms.

The strength of general relativity lies in the fact that this model describes the gravitational interaction between objects via its geometry, independently of any inertial frame of reference. This stems from the fundamental approach of focusing on the relativistic relationship between objects, which renders other influences on an observation irrelevant. The predictions match observations in the cosmological context with great precision. In the GTR model, the speed of light can safely be equated with the invariant quantity c as the maximum speed $V_{max} = c$. However, this involves measuring photons, which presuppose an undeformed surrounding space. During the experiment to measure light, it is not guaranteed that the measuring apparatus has also been compressed. It stands to reason that, if this fact is disregarded, the speed of light corresponds to the maximum speed. This refers to a measurement that is situated within the influence of a gravitational field such as that of the Earth, or which takes into account the inertial motion of the solar system, the galaxy and the universe. The measuring apparatus is therefore subjected to an external force that is not recorded, but which ought to affect a light measurement. This information is lost as long as only the gravitational relationship between objects is considered.

The doubt here does not lie in the concept of maximum speed. It is not plausible that the measured speed of light corresponds to the maximum speed as an inertial reference value if the Earth is not at rest, the galaxy is moving, and the surrounding universe generates a space-time deformation of its own. General Relativity yields more realistic results when the reference frame includes all objects and the mass of the universe. The introduction of a global inertial system could resolve this doubt and lead to further insights. The approach to potentially resolving the doubt once again starts from the Lorentz transformation.

The term $\frac{\sqrt{c^2 - V_{obj}^2}}{c}$ from the length contraction can also be reformulated mathematically as follows:

$$x' = x \sqrt{1 - \left(\frac{V_{obj}}{c}\right)^2} \tag{1.08}$$

→ The proportion $\frac{V_{obj}}{c}$ corresponds to the solution of a sine or cosine function for the angle 0° ... 90° or the radian measure between 0 ... $\frac{\pi}{2}$.

Thesis:

A field propagation velocity V_{Field} (the speed of light) follows its own reference frame relative to the maximum velocity V_{max} = c. It is only at the location of the relativistic inertial system that the field propagation velocity V_{Field} reaches the maximum velocity V_{max}, as the space-time-mechanical effects of the Lorentz transformation prevail with a factor of 1. All relativistic systems can alternatively be represented and stabilised trigonometrically. In this context, the state with an angle of 0° or 90° would be the point where a spatial segment experiences either the minimum Lorentz contraction with a factor of 1 or – as a fictitious maximum – infinity for a singularity. For this thesis, the Mach principle is disregarded. The result is formulated at the conclusion of **Chapter 2.4**.

In principle, the trigonometric representation of the Lorentz transformation results in two reference frames that could be considered as inertial frames for the theory of relativity:

$$\sqrt{c^2 - v_{obj}^2} = \sqrt{c^2 - c^2 \cos^2(kt)} \qquad \text{to:} = c \sin(kt) \qquad \text{or:} \tag{1.09}$$

$$\sqrt{c^2 - v_{obj}^2} = \sqrt{c^2 - c^2 \sin^2(kt)} \qquad \text{to:} = c \cos(kt) \tag{1.10}$$

The matter is therefore given a sin(kt) or cos(kt) dependent proper time. k is a characteristic constant that describes how often a period is repeated per second. The nominal time t describes the time interval that elapses between the start and end of a period T. The time t also describes the temporal sequence in Minkowski's metric. The time t thus refers to an inertial location without a deformed space-time. An object time

t_{obj} is relative to the time t that results from a space-time deformation and corresponds to the proper time of the object.

Note: The sine or cosine function maps the exact course of a spatially distorted spatial segment relative to the inertial system. Beyond 90°, the changing slopes must be taken into account for the remaining quadrants.

H. A. Lorentz's preliminary work therefore results in two possible reference systems that indicate the location of the inertial system. Both reference systems with their sine and cosine functions have a phase of 90° to each other. Both reference systems are therefore trigonometrically orthogonal to each other with regard to the maximum velocity $V_{max} = c$ and can be related to each other as velocity components using the Pythagorean theorem. That results in the square maximum velocity $V_{max}^2 = c^2$:

$$V_{max}^2 = c^2 = (c\sin(kt))^2 + (c\cos(kt))^2 = V_{obj}^2 + V_{field}^2 \qquad (1.11)$$

V_{obj} – object velocity relative to the maximum velocity $V_{max} = c$, it trigonometrically represents a cathetus of the Pythagorean triangle

V_{field} – field propagation velocity relative to the maximum velocity $V_{max} = c$, it trigonometrically maps the second cathetus

V_{max} – maximum velocity for objects, it trigonometrically maps the hypotenuse between the two cathets for V_{obj} and V_{field}

Which reference system belongs to the object velocity V_{obj} or the field velocity V_{field} is still open up to this point.

Insert into the Minkowski metric: $-\frac{dx^2}{dt^2} - \frac{dy^2}{dt^2} - \frac{dz^2}{dt^2} + V_{obj}^2 + V_{field}^2 = \frac{ds^2}{dt^2}$

The term $-\frac{dx^2}{dt^2} - \frac{dy^2}{dt^2} - \frac{dz^2}{dt^2}$ describes the quadratic vectorial observed object velocity in space and is therefore equal to the quadratic velocity component V_{obj}^2, which represents the cathetus relative to the quadratic maximum velocity $V_{max}^2 = c^2$.

with: $-\frac{dx^2}{dt^2} - \frac{dy^2}{dt^2} - \frac{dz^2}{dt^2} + V_{obj}^2 = 0$ → this results in: $V_{field}^2 = \frac{ds^2}{dt^2}$ (1.12)

Findings:

- ➔ A space-time deformation is characterised by a reduced field propagation velocity V_{field} and an increased object velocity $V_{obj.}$
- ➔ Photons propagate along a field propagation velocity V_{field}. A speed of light V_{field} is measured instead of the maximum speed $V_{max} = c$ in a resonator!
- ➔ Light has its own object time.
- ➔ The proper time of objects can therefore only be represented completely with these two reference systems or by a superordinate inertial system.

The obviously invisible or immeasurable processes of a reduced field propagation velocity V_{field} describe the effect of a field deformation during the space-time deformation. The description of such field deformations is the next step towards a 7-dimensional relativity theory of Field-Space-Mechanics (FSM-STR). The inertial system for this theory of relativity could provide information on how a space-time deformation is to be formulated via its field attributes.

The required inertial system for both reference systems $c \sin(kt)$ and $c \cos(kt)$ exists by definition at the location of the minimum length contraction, with the factor 1 for the formula (1.08). The maximum velocity $V_{max} = c$ can only be measured with the aid of light waves for the inertial case if the reference system for the field propagation velocity V_{field}, which represents the velocity of the photons, corresponds to the state of the inertial system. A perfect inertial frame would be found at this location. In order to finally answer the question of the inertial system, the two reference systems must be assigned to the velocities V_{obj} and V_{field}. This will be analysed in more detail in the next chapter.

The need to expand the 3D visible space into a 6D field-space:

Both reference systems have an influence on the state and effect of photons and must therefore be represented. Since the field propagation velocity V_{field} is not captured in the three-dimensional space of the *c*-metric system, a further 3-dimensional space is required to describe the processes governing the field propagation velocity V_{field} and to project the effect into visible space. In this way, the 3-dimensional space of the *c*-metric system is extended to six spatial dimensions. Therefore, both reference systems exist simultaneously for the object velocity V_{obj} as well as for the field propagation velocity V_{field} *c*-metrically and can thus be represented trigonometrically in relation to each other. Thus, both velocity parameters no longer evolve independently in a 4-dimensional relativistic manner, but are interdependent within a mathematically 7-dimensional, periodically repeating inertial motion. Trigonometrically, the resulting velocity is always the maximum velocity $V_{max} = c$, which, upon reduction of the metric, leads back to GTR. The metric is defined in **Chapter 2.2**.

<u>In other words, the context up to this point is as follows:</u>

In two reference systems moving uniformly in relation to each other, a flash of light emitted by a moving object with the speed V_{obj} in 3-dimensional space with a speed V_{field} always propagates as a spherical wave with the same speed *c* in a 6-dimensional space.

Figure 1.1 shows the previously derived relationship between the object velocity V_{obj} and the field propagation velocity V_{field}, relative to the maximum velocity $V_{max} = c$. The figure shows a 5-dimensional section of a 6-dimensional space. A 6-dimensional representation would ultimately run back into itself along its entire surface.

The object velocity V_{obj} marked in blue is the velocity that takes place vectorially in the particle-field $F_{1\text{-}3}$. This object velocity is represented in the wave-field $F_{4\text{-}6}$ orthogonally to the dimensional plane D_{56} as a yellow vector and has the same pointer length in the representation. The field velocity F_{field} is represented in the wave-field parallel to the dimensional plane D_{56}. In this way, a vectorial object velocity and a contracted field propagation velocity act simultaneously in the particle-field.

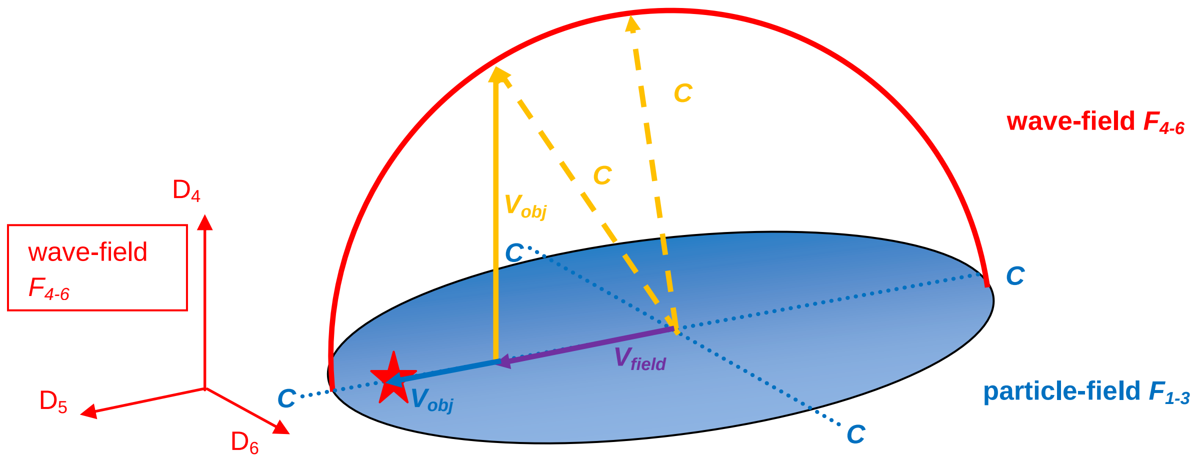

Figure 1.1: 5-dimensional representation of a field deformation for a moving object in field-space

Formula (1.11) for comparison:

$$c^2 = (c\ \sin(kt))^2 + (c\ \cos(kt))^2 = V_{obj}^2 + V_{field}^2$$

Up to this point, the answer is still pending as to which reference system according to formula (1.09) or (1.10) corresponds to the object velocity or the field propagation velocity and where the relativistic inertial system for both reference systems is located.

The next chapter first categorises both reference systems in a 6-dimensional field-space and describes some assumptions that must be made with the previous connections of space-time.

1.2 Definitions for Field-Space-Mechanics

Field-Space-Mechanics (FSM) is based on the realisation that 3-dimensional space R^3 must be extended to a 6-dimensional space R^6 in the *c*-metric system in order to represent and model field deformations. This chapter describes the terms associated with FSM and defines them via axioms.

Axiom 1a: The dimensions of space-time

Physical **space-time** is a 7-dimensional pseudo-Riemannian manifold, with one time dimension and six space dimensions of the so-called **field-space**, whereby three space dimensions represent the visible space in the particle-field $F_{1\text{-}3}$ and three represent the invisible space in the wave-field $F_{4\text{-}6}$.

Effect:

This axiom defines the basic structure of the FSM and enables the separation of visible and invisible matter.

Number of dimensions in Field-Space-Mechanics:

In addition to the dimension of time, the FSM model has six spatial dimensions:

- three spatial axes D_1, D_2, D_3 in index form as $D_{1\text{-}3}$ in the particle-field $F_{1\text{-}3}$

  The following applies to the unit vectors :

$$\vec{e_2} \times \vec{e_3} = \vec{e_1} \quad (1.13)$$
$$\vec{e_3} \times \vec{e_1} = \vec{e_2} \quad (1.14)$$
$$\vec{e_1} \times \vec{e_2} = \vec{e_3} \quad (1.15)$$

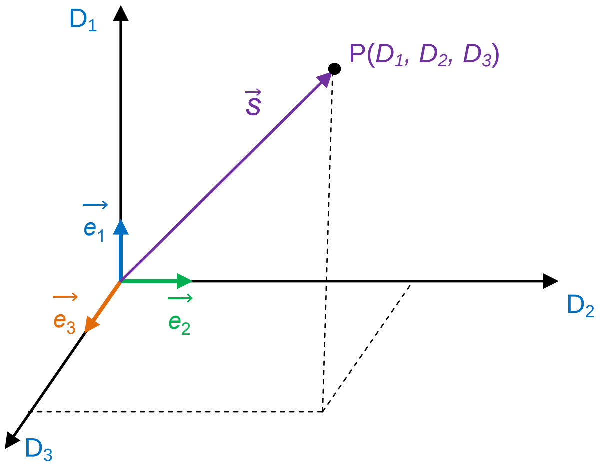

Figure 1.2: 3-dimensional representation of the particle-field $F_{1\text{-}3}$

- three spatial axes D_4, D_5, D_6 in index form as $D_{4\text{-}6}$ in the wave-field $F_{4\text{-}6}$

The following applies to the unit vectors:

$$\vec{e_5} \times \vec{e_6} = \vec{e_4} \quad (1.16)$$
$$\vec{e_4} \times \vec{e_6} = \vec{e_5} \quad (1.17)$$
$$\vec{e_4} \times \vec{e_5} = \vec{e_6} \quad (1.18)$$

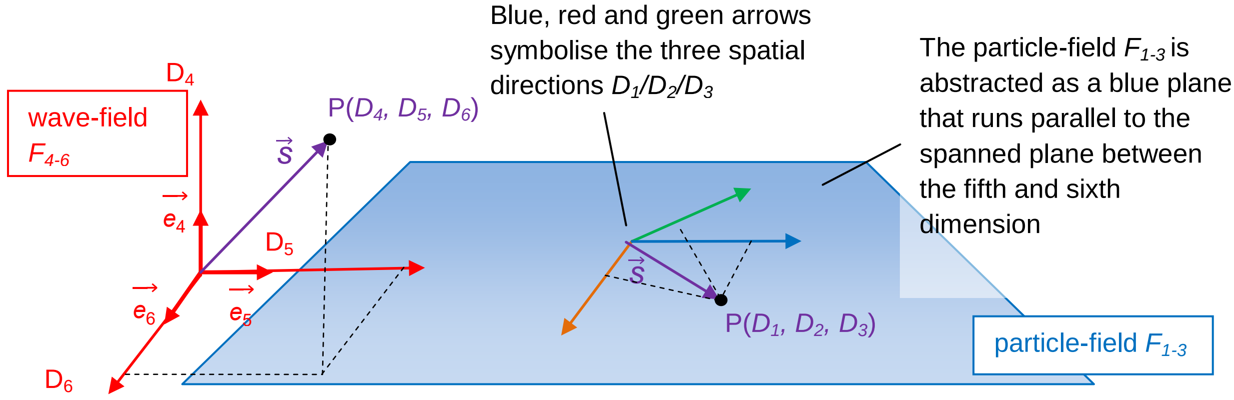

Figure 1.3: 6-dimensional representation of the field-space from the perspective of the wave-field $F_{4\text{-}6}$

Axiom 1b: The dimensions of space-time

By definition, **space-time is matter** and therefore forms an energy equivalent. This energy equivalent is proportional to the geometric expansion of space-time.

Effect:

An uneven distribution of energy within the space-time geometry deforms space-time, whereby the resulting space-time tension is directly proportional to the local energy gradient.

Axiom 1c: The dimensions of space-time

Space-time opposes the propagation of an electromagnetic wave, causing its propagation speed and thus its kinetic energy to be modelled relativistically.

Effect:

The effective inertial force of space-time thus determines the dynamics of spatial expansion. Consequently, the propagation behaviour of an electromagnetic wave is proportional to the expansion of space.

Axiom 2: The division of field-space into particle-field and wave-field

The six spatial dimensions of the field-space are divided into two orthogonal, 3-dimensional fields. The **particle-field** $\boldsymbol{F_{1\text{-}3}}$ produces discrete matter as field compressions and the **wave-field** $\boldsymbol{F_{4\text{-}6}}$ models waveforms as the cause of the effect in the particle-field. The particle-field is the effect, the wave-field is the cause, and they **exchange** their **fields** parallel to the **dimensional plane** $\boldsymbol{D_{56}}$.

Effect:

This axiom enables the unification of macrocosm and microcosm by describing discrete arbitrary particles as the effect of invisible waves.

The particle-field *F* with index $\boldsymbol{F_{1\text{-}3}}$ is the reference field that models visible matter as discrete objects. The particles in it are field compressions that act discretely and can be localised. The particle-field $F_{1\text{-}3}$ exchanges its field with the wave-field $F_{4\text{-}6}$ and vice versa. The total mass of the universe is distributed over both reference fields. The particle-field $F_{1\text{-}3}$ is linked to the wave-field $F_{4\text{-}6}$ by running parallel to the dimensional plane spanned between the so-called fifth and sixth dimensions. This area is shown as a blue area in **Figure 1.3.** A 6-dimensional space R^6 cannot be visualised in 3 dimensions. From the point of view of the wave-field $F_{4\text{-}6}$, the particle-field $F_{1\text{-}3}$ is therefore abstracted as a flat plane that runs back into itself as a band.

This perspective would be comparable to a hologram, which appears to the observer as a 3-dimensional image, but is actually 2-dimensional. Not all phenomena of a hologram (observer) can be predicted by a holographic measurement. The causes of localities lie in the processes of the wave-field $F_{4\text{-}6}$.

The wave-field *F* with index $\boldsymbol{F_{4\text{-}6}}$ is the reference field that produces fields in wave form. This reference field makes it possible to describe the quantum mechanical processes as the cause of the effect in the particle-field $F_{1\text{-}3.}$ The effects of space-time are also modelled as a cause in the wave-field $F_{4\text{-}6.}$ The pictorial difference between the particle-field $F_{1\text{-}3}$ and wave-field $F_{4\text{-}6}$ is that the wave-field $F_{4\text{-}6}$ resembles an ocean in which matter is not measurable. In contrast, the particle-field $F_{1\text{-}3}$ represents the water surface, which makes it possible to measure emitted fields as vibrating, evaporated water droplets and moving bodies in a velocity diagram.

Axiom 3: The dimensional planes

The **dimensional planes** D_{45}, D_{46}, D_{56} are the surfaces spanned between the compact wave-field dimensions D_4, D_5, D_6, on which photons move and interact. The unit vectors follow the cross product rules.

Here, $\overrightarrow{\mathbf{d}\boldsymbol{A}}$ stands for the vectorial area those results from two spanned dimensions.

$$\overrightarrow{e_6}\, dD_4 dD_5 = \overrightarrow{dA} = D_{45} \quad (1.19)$$

$$\overrightarrow{e_5}\, dD_4 dD_6 = \overrightarrow{dA} = D_{46} \quad (1.20)$$

$$\overrightarrow{e_4}\, dD_5 dD_6 = \overrightarrow{dA} = D_{56} \quad (1.21)$$

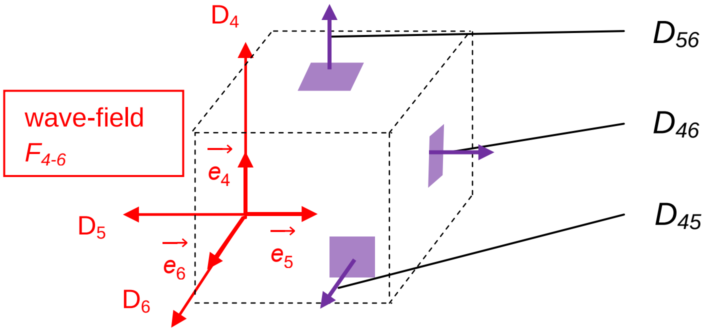

Figure 1.4: Representation of dimensional areas in the wave-field $F_{4\text{-}6}$

Effect:

This axiom ensures the geometric structure of the compact dimensions and enables mathematical representation during field exchange.

Axiom 4: The field-space dimensions

The **dimensions** of the **field-space** are antisymmetric and isotropic. The unit vectors follow the cross-product rules.

Effect:

This axiom ensures the antisymmetric geometry.

Axiom 5: The field propagation speed and object speed

The **speed parameters** $\boldsymbol{V_4}$ and $\boldsymbol{V_5}$ are orthogonal speed vectors that form the cathets of a Pythagorean triangle. In this triangle, the **maximum speed** $V_{max} = c$ forms the hypotenuse. The velocities are sinusoidal or cosinusoidal relative to the maximum velocities:

$$c^2 = (c \sin(kt))^2 + (c \cos(kt))^2 = V_4^2 + V_5^2 \quad (1.22)$$

The assignment is derived in **Chapter 2.1**.

Effect:

This axiom shifts the modelling of a space-time deformation into the wave-field.It enables the description of relativistic fields as the vibrational behaviour of matter using rotation matrices in the dimensional planes, e.g. D_{45} with $\overrightarrow{e_6}\, dD_4 dD_5 = \overrightarrow{dA} = D_{45}$.

The **object velocity V_3** is the velocity in the particle-field at which an object travels a certain measurable distance *s.* The index "3" denotes the three spatial directions $D_{1\text{-}3}$ of the visible part of the field-space.

The **field propagation velocity V_4** (corresponds to: V_{obj}) denotes the velocity of a field that runs through the fourth dimension of the field-space and acts parallel to an object velocity V_3.

The **field propagation velocity V_5** (corresponds to: V_{field}) denotes the velocity of a field that runs through the fifth dimension of the field-space and reflects the propagation velocity of fields in the particle-field.

<u>Axiom 6: The field angle *α*</u>

The **field angle *α*** describes the angle between the field propagation velocity V_5 in the fifth dimension or the field propagation velocity V_4 in the fourth dimension in relation to the maximum velocity V_{max}. This angle measurement takes a snapshot of all relativistic quantities as a phase from a rotation that occurs within a space-time deformation relative to the inertial system. The field angle [α] is in angles °.

Effect:

This axiom relates gravitational states to geometry depending on their oscillatory contributions.

<u>Axiom 7: Field deformation</u>

A **field deformation** in particle-field $F_{1\text{-}3}$ represents the proportional effect of a space-time deformation on arbitrary fields and their velocity vectors in wave-field $F_{4\text{-}6}$. The cause of a field deformation is modelled by the relativistic ratio of the two vectors for field propagation velocities V_4 and V_5, which act in their respective reference systems according to formulas (1.09) and (1.10) in the wave-field $F_{4\text{-}6}$. Both velocity vectors are subsequently defined by the indices, which in turn mark the action space in which they clearly develop their respective share of the effect on angular momentum. For simplicity, the velocity vectors are further represented in magnitude form with their indices.

Effect:

This axiom enables matter to be described as a geometric effect.

Figure 1.5 shows the previous result for a field deformation under the above defined designations for the field-space. There is no field deformation if the field propagation velocity V_5 corresponds to the maximum velocity with $V_{max} = c$. A field deformation occurs as soon as the field propagation velocity V_5 with $V_5 < c$ is present. The calculable speed of light corresponds to the velocity vector V_5.

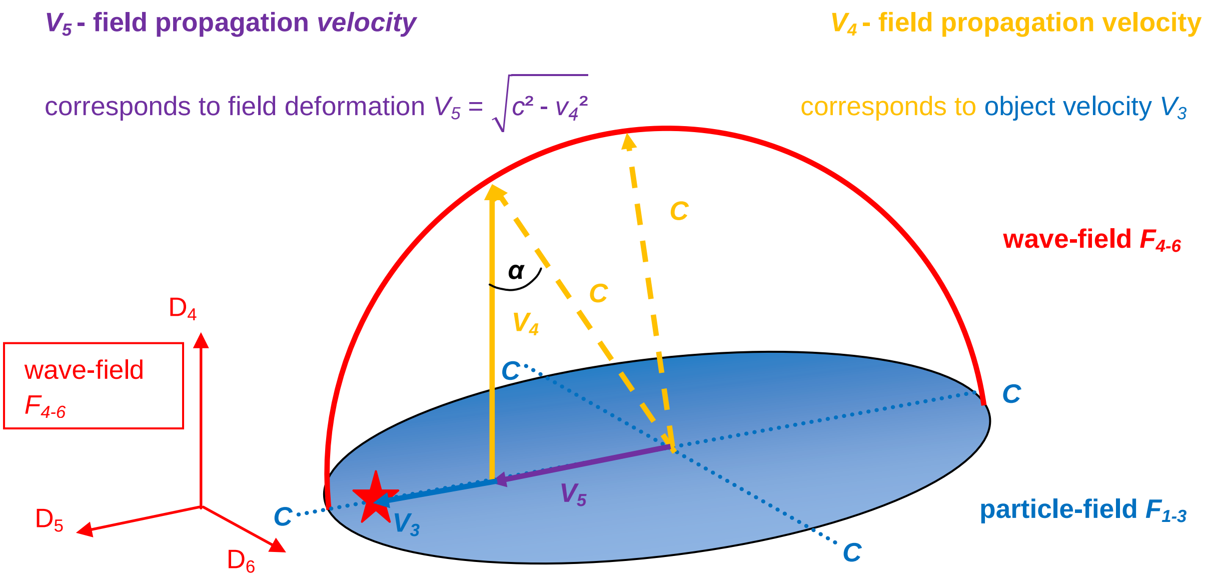

Figure 1.5: Adjusted indices for a field deformation in field-space

The field angle *α* shown in **Figure 1.5** corresponds to the general factor (*kt*) in the formulae (1.09) and (1.10) and thus describes the dynamics of the expansion of a photon and of the universe as a whole of all photons. Gravity and electrodynamics are described in the same geometric structure in a freely scalable manner.

Axiom 8: The principle of action in FSM

The dynamics of the universe are determined by the principle of **least action** in 7-dimensional space-time, whereby action combines geometric fields and hollow body vibrations.

Effect:

This axiom explains why field bodies, from photons to the size of a universe, periodically expand and contract.

Axiom 9: Scalability across all orders of magnitude

FSM is scalable across all physical orders of magnitude, from subatomic structures to the cosmos. **Matter and energy are geometric effects that operate through relativistic fields at all scales.**

Effect:

This axiom connects the microcosm with the macrocosm.

Axiom 10: The photon field of the universe is the fundamental field

The entire matter of the universe is realised as a **photon field** which is subject to space-time mechanical processes. The photon field is the basic electromagnetic field that fills the entire cosmic field-space and provides the matter for the two reference fields, namely particle-field $F_{1\text{-}3}$ and wave-field $F_{4\text{-}6}$. Depending on the cosmic space-time deformation, this photon field manifests itself relativistically with a higher field density as wave-field $F_{4\text{-}6}$ and a lower field density as particle-field $F_{1\text{-}3}$.

Effect:

This axiom explains the source of matter within the universe.

Axiom 11: The global, electrical potential of the universe

Matter is formed orthogonally above and below the dimensional plane D_{56}. These formations parallel to the fourth spatial dimension act like **two electrical voltage potentials**, separated by the dimensional plane D_{56}. With the dynamic expansion of space in the universe, these two voltage potentials continue to act as a displacement current between two charged capacitor plates. The minimum of the voltage potentials can therefore be found at the location of the minimum length contraction for a space segment.

Effect:

This axiom explains how matter generates an electric potential. It makes it possible to explain and calculate particles of varying complexity.

Axiom 12: The particle model and coupling frequencies

The **particle model** replaces point particles with hollow body vibrations in the wave-field, which generate relativistic fields. The **coupling frequencies** are derived from the electron frequency, and **object masses** are derived from the electron mass as the base quantity for the minimum excitation.

Effect:

This axiom enables the unification of fundamental forces.

Axiom 13: The minimum coupling frequency for fine structures

From the **minimum coupling frequency** onwards, photons are able to interact electrically with their environment. From this frequency onwards, invisible photons from the dark energy pool enter into an electrical interaction within the photon field.

Effect:

This axiom enables the separation and description of uncoupled (dark) energy and coupled energy.

Axiom 14a: Photons in a bundle

Photons from a bundle of several photons are able to approach each other at a recurring point of contact in the wave-field $F_{4\text{-}6}$ to a **minimum distance** of their wavelength **($\lambda \sim 0$)**.

Effect:

There is no collapse upon approach, but rather a field exchange at the point of greatest deflection.

Axiom 14b: Photons in a bundle

The frequency of individual photons from a bundle of several photons reaches its **maximum deflection** when they oscillate at an integer multiple of the frequency of the bundle. The field strength is therefore strongest when the photons are at their common **point of contact**.

Effect:

The interaction from the wave-field $F_{4\text{-}6}$ into the particle-field $F_{1\text{-}3}$ occurs with its amplitude. A measurement in the wave-field registers a sinusoidal deviation or disturbance relative to the amplitude during the ongoing period.

Axiom 14c: Photons in a bundle

A **field exchange** between particles takes place at a distance equal to half their wavelength $\frac{\lambda}{2}$.

Effect:

The distances between two objects involved in an interaction can be predicted on the basis of their particle structure.