Chapter 2 Relativistic Consideration of Field-Space-Mechanics

2.1 Special Theory of Relativity of Field-Space-Mechanics

Creating the inertial system:

Both velocity parameters V_4 and V_5 each form a reference system in relation to the maximum velocity $V_{max} = c$. Due to the orthogonal alignment of the dimensional plane D_{45} to D_{56}, the following applies to each other: $V_4^2 + V_5^2 = c^2$.

Extreme cases:

An object moves in the particle-field with $V_3 = V_4 = c$, then $V_5 = 0$ applies.

An object moves in the particle-field with $V_3 = V_4 = 0$, then $V_5 = c$ applies.

Special case for the measurable photon in the particle-field: $V_3 = V_5 = c$, then $V_4 = 0$ applies

Figure 2.1 supplements **Figure 1.5** with two possible observation points for the detection of a field deformation within a 6-dimensional field-space, which could be observed outside a space-time deformation.

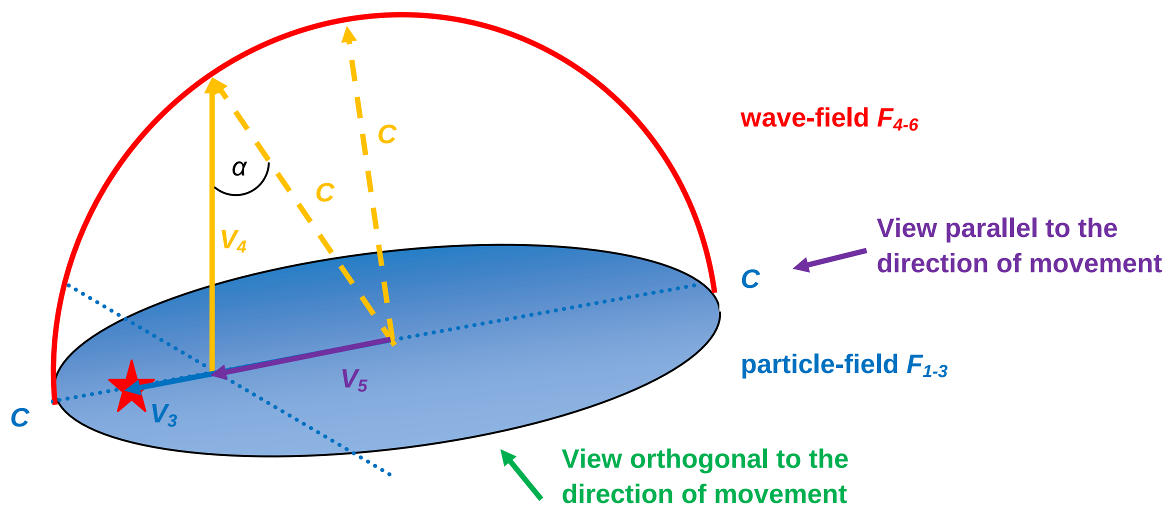


Figure 2.1: 5-dimensional representation of the field deformation supplemented with the labelling of a parallel and orthogonal observer perspective

The blue arrow describes the speed of an object within an imaginary light resonator. The reflection of emitted photons occurs at the edge. From the object's point of view, the light emitted in the opposite direction with the maximum speed $V_{max} = c$ appears to move away relatively with $c + V_3$ and catches up again with $c - V_3$ after hitting the resonator. The light emitted in the direction of movement initially moves away from the object relatively with $c - V_3$ and appears to return with $c + V_3$. As all photons in a resonator must meet again simultaneously at one point by definition of the maximum speed, a field deformation effect in the direction of movement with $\sqrt{c^2 - v_3^2}$ applies to the object due to its object speed V_3. The path component for the propagation of light in the direction $c - V_3$ and $c + V_3$ can be represented with the same total value at the location of the inertial system. For the field propagation velocity V_4 shown in **Figure 2.2**, the definition applies that the magnitude is equal to the object velocity V_3.

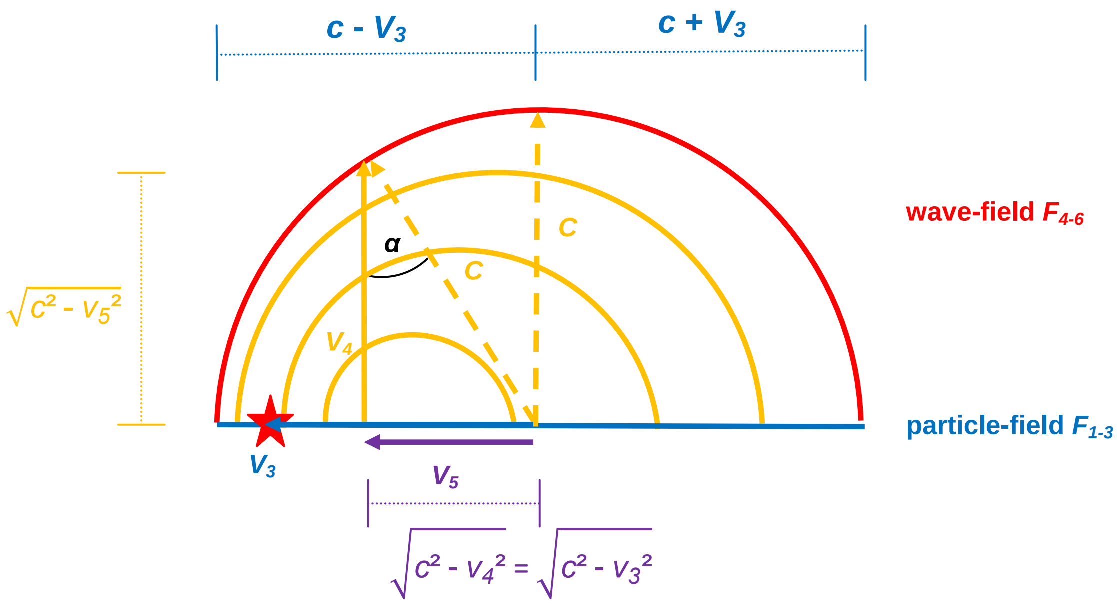


Figure 2.2: Field deformation orthogonal to the direction of movement, 4-dimensional representation

At maximum speed $V_{max} = c$ in the direction of movement towards the object:

$$V_a = \frac{\text{Raum}}{\text{Zeit}} = c\,\frac{(c - V_3)}{\sqrt{c^2 - V_3^2}} = c\sqrt{\frac{c - V_3}{c + V_3}} \qquad (2.01)$$

With maximum speed $V_{max} = c$ against the direction of movement of the object:

$$V_b = \frac{\text{Raum}}{\text{Zeit}} = c\,\frac{(c + V_3)}{\sqrt{c^2 - V_3^2}} = c\sqrt{\frac{c + V_3}{c - V_3}} \qquad (2.02)$$

Temporally resulting clocking t_{res} for an imaginary resonator over an equal path s:

$$t_{res} = t_{hin} + t_{her} = \frac{s}{V_a} + \frac{s}{V_b} = \frac{2s}{\sqrt{c^2 - V_3^2}} \tag{2.03}$$

This speed of light is measured in a light resonator over a distance s if the observer is orthogonal to the direction of movement:

$$V_{res} = V_5 = \sqrt{c^2 - v_3^2} \tag{2.04}$$

A **space-time deformation** caused by a moving object in the particle-field $F_{1\text{-}3}$ with an object velocity V_3 acts in the wave-field $F_{4\text{-}6}$ with the field propagation velocity V_4 **orthogonally** to a **field deformation**, which in turn is expressed by the field propagation velocity V_5. The speed of light is reduced to the field propagation velocity V_5 with the term $\sqrt{c^2 - v_3^2}$. Lorentz contraction and gravitational redshift are perceived as real space-time mechanical effects for the 5-dimensional view of space.

→ The trigonometric solution for the space-time deformation is:

$$V_4 = V_3 = c \cos(\alpha) \tag{2.05}$$

→ The trigonometric solution for the field deformation is:

$$V_5 = c \sin(\alpha) \tag{2.06}$$

→ For length contraction: $x' = x \sin(\alpha) = x \frac{V_5}{c}$ (2.07)

The object time of the moving object must be slower by a factor of $\frac{c}{\sqrt{c^2 - V_3^2}}$ than in a reference system that is at rest with respect to the surrounding field-space.

→ The trigonometric solution for the object time is:

$$t_{obj} = \frac{c}{V_5} t = \frac{t}{\sin(\alpha)} \tag{2.08}$$

The greater the field propagation velocity V_4 is effected, the longer the periodic inertial movements in the wave-field $F_{4\text{-}6}$, which extends the object time.

An inertial frame can be determined by assigning both velocity parameters $V_4(t) = c\cos(\alpha)$ and $V_5(t) = c\sin(\alpha)$. At the end of the spatial expansion of the universe with the maximum volume radius $r(t) = r$, the space-time mechanical effect with the Lorentz factor 1 for $V_5(t) = c\sin(\alpha)$ is present. This corresponds to the minimum length contraction of a spatial segment. The field angle α is 90° in this case. In the FSM model, the space-time mechanical effects are considered relative to the minimum Lorentz contraction at the point of maximum expansion of the universe. These results provide a reference point for space-time and its space-time mechanical equalising forces during the expansion of the universe, which gives it a beginning and an end according to the extreme cases mentioned above. If there were an imaginary observer outside the universe, then this observer could register the field propagation velocity V_5 depending on space-time mechanical influences in the universe. The imaginary observer recognises the electromagnetic photon field and the accelerated movement of the space expansion of the universe with $r''(t)$ from outside. The length of a space segment is now registered as dynamic. From the point of view of the inertial system, electromagnetic waves such as those of a visible photon are always detected as a gravitational redshift in the area of influence of a space-time deformation.

The observer should now stand parallel to the direction of movement in the universe and recognise the space-time mechanical effects:

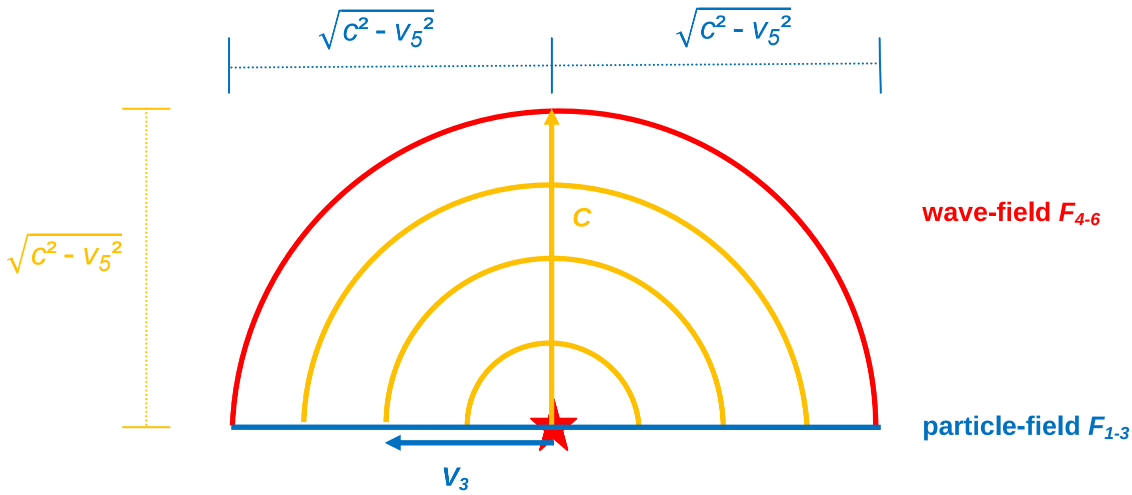


Figure 2.3: Field deformation parallel to the direction of movement

Lorentz transformation of time: The time dilation resulting from the Lorentz transformation and the gravitational redshift is also recognised.

Lorentz transformation of space: Parallel to the direction of movement, no contraction can be detected because the observer does not detect any change in the maximum velocity $V_{max} = c$.

The speed of light from a parallel perspective:

$$V_{res} = c \frac{\sqrt{c^2 - V_5^2}}{\sqrt{c^2 - V_5^2}} = c \qquad (2.09)$$

The light resonator determines the field propagation velocity with the maximum velocity $V_{max} = c$ instead of with a shortened V_5, with and without the influence of the moving reference system. Even if the resonator were located in a non-moving reference system with $V_3 = 0$, the speed of the light could also only be determined with this value c. The observer is therefore unable to determine the magnitude of his own length contraction if the direction of motion is parallel. All other spatial directions result in the same solution from this perspective.

A field deformation between the current field propagation velocity V_5 and the maximum velocity $V_{max} = c$ is only registered if the observer is outside the influence of the space-time deformation and observes a movement orthogonal to the direction of movement.

Findings from FSM-STR for 7-dimensional field-space with time:

1) The field propagation velocity V_4 is proportional to the space-time mechanical effects of a space-time deformation.
2) The field propagation velocity V_5 is proportional to the space-time mechanical effects of a field deformation.
3) The field propagation velocity V_5 corresponds to the speed of light of photons.
4) An object with an object velocity V_3 in the particle-field F_{1-3} can move through the connection in the wave-field F_{4-6} by reducing its field propagation velocity V_5 in favour of V_4:
   →an object moves in the particle-field with $V_3 = V_4 \rightarrow c$, then $V_5 \rightarrow 0$
   →an object moves in the particle-field with $V_3 = V_4 \rightarrow 0$, then $V_5 \rightarrow c$
5) A measurable photon propagates faster and faster with $V_5 = c \sin(\alpha)$ as the universe expands and the space-time mechanical effects diminish.

Interpretation of the Lorentz factor for FSM:

Case a. Lorentz factor = 1:

The space-time deformation is minimal. Space-time slows down the field propagation velocity V_5 to the maximum velocity $V_{max} = c = V_5$.

Case b. Lorentz factor > 1:

There is an increased space-time deformation, which requires additional energy for the contraction work. The field propagation velocity V_5 is contracted relative to the maximum velocity $V_{max} = c$. In **Chapter 7**, the cosmic processes are calculated for cases with a Lorentz factor > 1.

Case c. Lorentz factor < 1:

As soon as the Lorentz factor falls below 1, an electromagnetic wave expands further in space-time. Consequently, a wave period with its field propagation speed V_5 travels a greater distance relative to the nominal case with the maximum speed V_{max}. This case has not yet been observed.

2.3 Sinusoidal Periodicity, global and local Gravitational Force

In this chapter, the expansion behavior of the universe is abstracted as a wave motion. During a sinusoidal period *T*, distinct forces act at different time intervals. At the beginning of the universe, the greatest contraction of its photon field occurs, with the highest energy density. A contraction requires additional work to stabilize the system. This contraction already possesses the necessary additional energy. Nature, for its part, always strives for the lowest energy state for a stable system. The contraction energy can be reduced by increasing the volume of space. The relativistic state of the Lorentz transformation with a factor of 1 provides the energetically favorable location in space-time for minimal contraction. Thus, an inertial force builds up, which decreases again with expansion. Space-time opposes this inertial force. A counterforce acts – the gravitational force, which dampens this inertial force and generates a global curvature or space-time deformation. Due to the relativistic conditions of the contraction, the gravitational force is strongest at the beginning and weakens until maximum expansion is reached.

A space-time potential exists between the beginning and end of the expansion. This is to be defined as **gravitational potential** with **~ d*M*(*α*) = *M* cos(*α*)**. The solid angle *α* places the gravitational potential in a trigonometric relationship that abstracts the universe's state of contraction globally in wave form. Between cos(0°) and maximum expansion cos(90°), the following applies: cos(0° > *α* < 90°) – cos(90°) = 1…0. With positive signs, attractive forces prevail. The velocity parameters V_4 and V_5 simultaneously describe the progression of space-time curvature and the contraction of the global speed of light relative to the maximum speed *c*. They align geometrically with the course of the gravitational potential and describe, on the same plane, the space-time-mechanical states according to formulas (2.05; 2.06; 2.07). Thus, visible photons, as carriers of light, reach the maximum speed $V_{max} = c$ when they are no longer slowed down by any counterforces from space-time. The minimum value of the global gravitational forces, which lies at the location of the inertial system and has a Lorentz contraction factor of 1, acts there with **d*M*(*α* = 90°; *α* = 270°)** für **$V_5 = c$; $V_4 = 0$**.

Mathematically, based on the graph of the cosine function, the universe beyond 90° would have a negative sign for its gravitational potential. The gravitational potential between 90° and 180° is:

cos(90° > *α* < 180°) – cos(90°) = 0…-1. With a negative sign, the gravitational force acts repulsively. When gravity acts repulsively, space-time drives the inertial force to increase again in the opposite direction. Space-time is then contracted again. Why, starting from a stable, energetically balanced state, would the mechanism cause the universe to contract again? This is explained by the vibrational nature of the universe as an electromagnetic wave. There is nothing in the universe that could mechanically stop its wave motion. In this way, the universal angular momentum is conserved and thus continues its global oscillatory motion. The fact that gravity acts repulsively or attractively across the quadrants of a sinusoidal period T is, globally viewed, merely a side effect and is defined by the initial state.

270° < *α* < 90° attractive and **90° < *α* < 270°** repulsive field forces

In summary:

The magnitude of the inertial force is determined by its universal constant (2.177). Its relativistic behavior is described by the sine periodicity (2.164) using the reciprocal of the sine function. The gravitational potential d$M(\alpha)$, with its cosine function at the point of relative rest with dM(90°) (Lorentz factor 1), indicates in which quadrant an attractive or repulsive gravitational force prevails. The field propagation velocity V_4 describes, in parallel with the cosine function, the expansion characteristics of the volume space and represents the component for modeling the space-time deformation. The field propagation velocity V_5 runs parallel to the speed of light in the form of a sine function and indicates the prevailing field deformation.

If an infinitesimal number of measurement points are recorded for the field deformation relative to the inertial frame, a prospective trajectory curve is generated over a period T. This trajectory curve describes a state representation of the universe in space-time during a complete period as an electromagnetic wave and is shown in **Figure 2.6**. The particle-field is abstracted as a two-dimensional blue band and is completely self-connected.

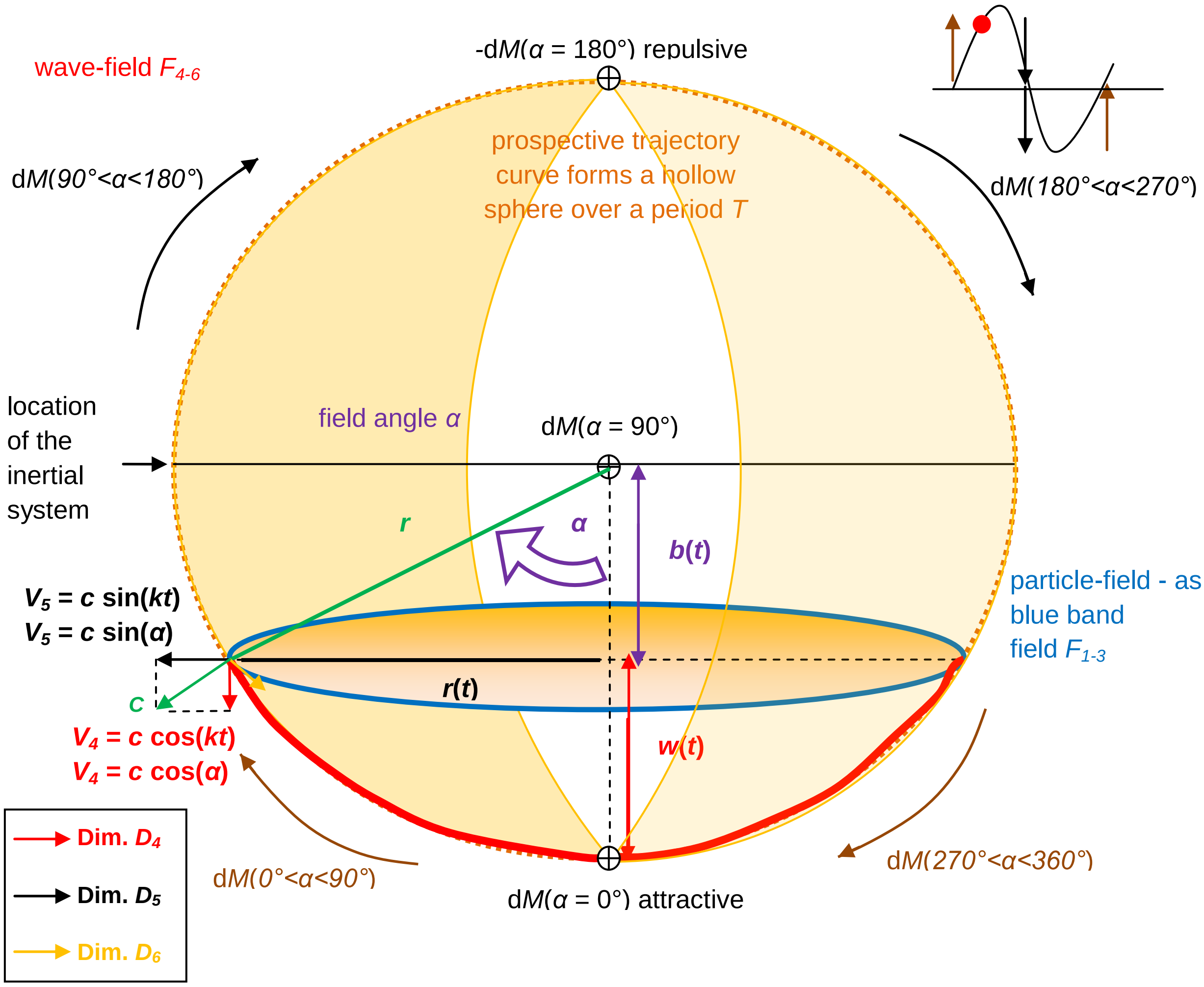


Figure 2.6: 7-dimensional state diagram of the universe with one oscillation period

In a 6-dimensional field-space with a 5-dimensional surface, several 4-dimensional subspaces could arise mathematically between the wave-field $F_{4\text{-}6}$ and the particle-field $F_{1\text{-}3}$. These **4-dimensional field bodies** form the **quantised matter** within the photon field.

Derivation of the sine periodicity of the universe:

The gravitational force always exists between objects plus the prevailing gravitational potential dM(α). This gravitational potential changes sinusoidally for the universe and all objects in it during a full period. The sinusoidal periodicity ultimately describes the force of relativistic surface gravity between its photon field and any quantisable matter in the universe at any point in its space-time deformation.

$$F_{gravity} = \frac{G\,M\,m}{r^2}$$ (Newton's law of gravity)

$r(t) = \frac{1}{2}at^2$ $v(t) = \int a(t)$ $r'(t) = v(t)$

$r(t) = \iint a(t)$ $v(t) = at$ $r''(t) = a(t)$

G	- gravitational constant	m_{obj}	- mass of an object
M_{Uni}	- mass of the universe	r_{Uni}	- maximum field radius of the universe
F	- force between M_{Uni} and m_{Obj}	α	- field angle
r(t)	- volume radius at a certain time t		
v(t)	- velocity at a specific time t		
a(t)	- acceleration		

$$\frac{G\,\mathrm{d}M(\alpha)\,m_{obj}}{r^2} = a(t)\,m = \frac{\int^{\alpha\text{-field angle}} G\,\mathrm{d}M(\alpha)\,m_{obj}\,\mathrm{d}\alpha}{r^2}$$ and $r(t) = r\sin(\alpha)$

$r(t)$ is the variable volume radius of the universe depending on the gravitational potential d$M(\alpha)$ to an object with mass m.

For $F(r) = \frac{\mathrm{d}M}{\mathrm{d}r\,r}$ applies:

Maximum possible gravitational potential between d$M(\alpha)$ and m_{Obj} results from:
dM(~0) = M_{Uni} cos(~0) → at the birth of the universe

The gravitational potential along the field angle α is given by:
d$M(\alpha)$ = M_{Uni} cos(α)

- ➔ Depending on the sign of the cos(α), attractive and repulsive forces result.
- ➔ The relativistic gravitational force runs in the reference field $F_{4\text{-}6}$ with the cosine function parallel to the field propagation velocity V_4. The smaller the field angle α between objects with a mass m_{Obj} and the location d$M(\alpha \rightarrow 0)$, the greater the gravitational forces between them.
- ➔ The gravitational potential of matter diminishes with the expansion of the universe.

If the universe is exactly mirrored at the location d$M(\alpha = 90°)$ and -d$M(\alpha = 270°)$, then the field force effect of matter is minimal.

The gravitational force $F_{gravity}$ for the universe is considered relativistically by describing its gravitational potential d$M(\alpha)$ as a function of its current extent $r(t)$.

$$\mathrm{d}M(\alpha) = M_{Uni}\cos(\alpha)\,\mathrm{d}\alpha \quad \rightarrow \text{gravitational potential} \tag{2.161}$$

For the universe and all its subspaces, a surface measure for the space-time mechanical effects must be observed, as it represents the field-space in six dimensions as a mathematical hollow sphere.

Classic:

$A_O = 4\pi\, r^2$ → Surface area for the sphere; r – radius (2.162)

Relativistic:

$$4\cancel{\pi}\, r^2 = 4\cancel{\pi}\, \frac{r(t)^2}{\sin^2(\alpha)} \quad \rightarrow \; r(t)^2 = r^2 \sin^2(\alpha) \qquad (2.163)$$

After crossing the inertial system, the pointer for the direction of action changes trigonometrically.

for: 270° < α < 90° attractive and 90° < α < 270° repulsive effect of the field forces

Insert into the equation of force:

$$F_{gravity}(t) = a(t)\, m = \frac{G\, dM(\alpha)\, m_{obj}}{r(t)^2} = \frac{\int^{\alpha\text{-field angle}} G\, M_{Uni}\, m_{obj}}{r(t)^2} \cos(\alpha)\, d\alpha$$

$$F_{gravity}(t) = \frac{G\, M_{Uni}\, m_{obj}}{r(t)^2} \int^{\alpha\text{-field angle}} \cos(\alpha)\, d\alpha \qquad \text{with: } \int_0^{\alpha} \cos(\alpha)\, d\alpha = \sin(\alpha) - \sin(0)$$

$$\boxed{F_{gravity}(t) = \frac{G\, M_{Uni}\, m_{obj}}{r(t)^2} \sin(\alpha) = \frac{G\, M_{Uni}\, m_{obj}}{r^2} \frac{1}{\sin(\alpha)}} \qquad [F] = \mathrm{N} \qquad (2.164)$$

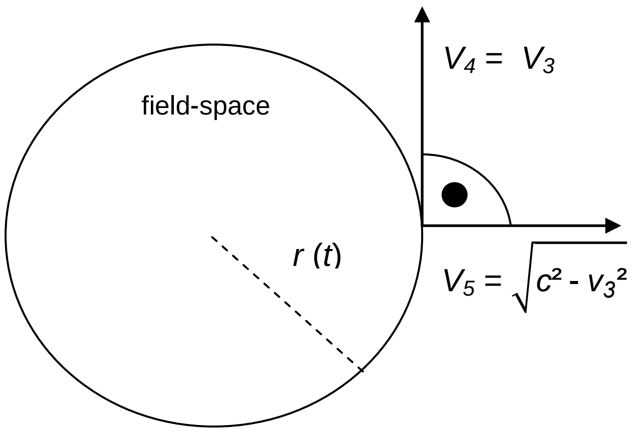
<u>Findings:</u>

- ➔ The course of the relativistic gravitational force of the photon field is sinusoidal-periodic
- ➔ The sine function reflects the field shape of the deformed space-time
- ➔ In this representation, the object mass m_{obj} does not have its own vectorial proper motion. Space-time mechanical effects act in addition to the space-time deformation of the universe in the event of possible proper motion.

The sign of the rise in the sine wave corresponds to the direction of its gravitational force. If the slope of the sine function is therefore positive, then attractive forces prevail, whereas repulsive forces act on a negative slope.

<u>From STR-FSM to GTR-FSM:</u>

To generalize the relativistic relationship, the space-time-mechanical effects must be modified from the fixed field propagation speeds V_4 and V_5 and the corresponding field angle α to a dynamic acceleration dependent on the nominal time t. In other words, this means that the dynamic expansion of the universe also changes the object time of its fields. The field propagation velocity V_4 decreases at a reduced rate, while the field propagation velocity V_5 increases at an accelerated rate. **Figure 2.7** uses the mathematical hollow sphere to relate the relativistic relationship between the maximum velocity $V_{max} = c$ and an object velocity V_3 in the particle-field with the variable volume radius $r(t)$:



This results in the following equation for the field angle α:

$$\alpha = \int_0^t \frac{\sqrt{c^2 - V_3^2}}{r(t)}\,dt \qquad (2.165)$$

Figure 2.7: View of the hollow sphere

$$\alpha = \int_0^t \frac{\sqrt{c^2 - V_3^2}}{r(t)}\,dt$$ → The field angle [α] in angle °

$$\frac{\sqrt{c^2 - V_3^2}}{r(t)} = \frac{c\,\cancel{\sin(\alpha)}}{r\,\cancel{\sin(\alpha)}} = \frac{c}{r} = k = \text{constant} \qquad (2.166)$$

The field angle α parameterises the available gravitational potential d$M(\alpha)$ for an object mass m_{Obj} at all locations in the universe. For the FSM-GTR, the field angle α is generalised as follows:

$$\alpha = \sin^{-1}(kt)\ \text{(general)} \qquad \alpha = \sin^{-1}\left(\frac{V_5}{c}\right)\ \text{(special)} \qquad (2.167)$$

<u>7-dimensional FSM-GTR between two objects in the universe:</u>

The effect of the gravitational force, taking into account the sinusoidal periodicity, relates to the photon field and thus also to all objects in the universe simultaneously. A single object as part of the photon field cannot register its own gravitational force without any other object. For the relativistic observation of objects within the universe, gravitational forces can only be made measurable between at least two objects. The mutual attraction of objects requires at least two gravitational fields of their own. Thus, within the sinusoidal periodicity of the universe, an additional local deformation of space-time applies between two objects.

For a force F, an acceleration of $a_5(t) = r''(t)$ acts on an object. The acceleration $a(t)$ is already determined by the sine periodicity. In order to represent the additional deformation in space-time caused by two objects within the photon field, the formula (2.164) is extended with the product of the factor sin(kt) for object 1 and a further factor sin(kt) for object 2.

Derivation of the relativistic force formula between two objects:

$r(t) = \frac{1}{2} a t^2$ $\quad r(t) = \iint a(t)$ $\quad v(t) = at$ $\quad v(t) = \int a(t)$

$r'(t) = v(t)$ $\quad r''(t) = a_5(t)$

k - angular frequency $\quad$ t - elapsed time along the period time T

With the help of trigonometry, mathematical expressions for the solutions of the FSM-GTR are obtained:

$$r(t) = r \sin(kt);\ r'(t) = r\,k \cos(kt) = V_4(t);\ |r''(t)| = |a_5(t)| = |- r\,k^2 \sin(kt)| \qquad (2.168)$$

Between two accelerated (scalable) moving objects within a sine-periodic universe, the aforementioned additional quadratic factor for the space-time deformation is obtained with $\sin^2(kt)$:

$a_5(t) = r''(t) = a(t) \sin^2(kt)$:

$$F_{gravity}(t) = m\,r''(t) = m\,a(t) \sin^2(kt) = \frac{G\,m_{obj1}\,m_{obj2}}{r(t)^2} \sin(\alpha) \sin^2(kt):$$

$$\text{with: } \alpha = \int_0^t \frac{\sqrt{c^2 - V_3^2}}{r(t)}\,dt = \int_0^t \frac{c}{r}\,dt = kt$$

$$F_{gravity}(t) = \frac{G\,m_{Obj1}\,m_{Obj2}}{r(t)^2} \sin(kt) \sin^2(kt) \qquad (2.169)$$

with the variable radius of the universe: $r(t) = r \sin(kt)$ (2.170)

$$F_{gravity}(t) = \frac{G\,m_{obj1}\,m_{obj2} \sin(kt)\,\cancel{\sin^2(kt)}}{r^2\,\cancel{\sin^2(kt)}} \qquad \text{with: } \sin(kt) = \frac{r(t)}{r}$$

$$F_{gravity}(t) = \frac{G\,m_{obj1}\,m_{obj2}\,r(t)}{r^3} \qquad (2.171)$$

$$F_{gravity}(t) = \frac{G\,m_{obj1}\,m_{obj2}}{r^2} \sin(kt) \qquad (2.172)$$

to formula (2.172): r^2 - quadratic distance between the two objects

In the wave-field $F_{4\text{-}6}$, the formulae (2.171) and (2.172) describe that a field emission between two objects has a maximum effect if it is transmitted parallel in the dimensional plane $D_{56.}$ The maximum unfolds with sin(α = 90°) = 1. A quantised field is maximally mediated when the formation of 4-dimensional subspaces is orthogonal, i.e. α = 90° to the dimensional plane D_{56}. This configuration is used in the photon model.

The formulae (2.171) and (2.172) describe objects in the particle-field $F_{1\text{-}3}$ that have angular momentum within the universe and, due to their inertial motion, have the greatest effect of their gravitational force orthogonal to their axis of rotation, while their centrifugal force tends to a maximum near the poles. These formulae explain the inertial motion of an approaching object along its spherical sector, which is caused by a centrally rotating gravitational field.

The FSM-GTR derives the solution for the field radius r and the angular frequency k from the acceleration $a_5(t) = r''(t)$. The total mass of the photon field and the gravitational constant remain unchanged. If the field radius of quantised matter is sought, the indices of the mass are swapped accordingly. The second derivative of $r(t)$ from the force equation (2.171) must be used:

$$r''(t) = F_{gravit}(t)_y \frac{1}{m_{obj2}} = \frac{G\, m_{obj1}\, r(t)}{r^3} \qquad \rightarrow \text{Acceleration on an object}$$

→ 2nd order differential equation: characteristic part of the equation

$$r''(t) - \frac{G\, m_{obj1}\, r(t)}{r^3} = 0 \qquad \text{with: } r(t) = e^{kt}\,;\; r'(t) = k e^{kt}\,;\; r''(t) = k^2 e^{kt}$$

Insert into differential equation:

$$k^2 e^{kt} - \frac{G\, m_{obj1}}{r^3} e^{kt} = 0 \qquad \rightarrow \qquad e^{kt}\left(k^2 - \frac{G\, m_{obj1}}{r^3}\right) = 0$$

Characteristic equation:

$$k^2 - \frac{G\, m_{obj1}}{r^3} = 0 \rightarrow k_{1/2} = \pm\sqrt{\frac{G\, m_{obj1}}{r^3}} \rightarrow \boxed{k = \sqrt{\frac{G\, M}{r^3}}} \qquad [k] = \frac{1}{\text{s}} \qquad (2.135)$$

→ continue with the temporal amount

The volume radius $r(t)$ with the smallest field influence corresponds to the expansion of the universe at $r(t) = r$, the extreme value calculation for V_5 with the first derivative of $r(t)$ results:

$$c = V_5(0) = r'(0) = r \sin'(k\, 0) = r\, k \cos(0) = r\, k$$

$$c = r\sqrt{\frac{G\,m_{obj1}}{r^3}} \rightarrow c^2 = r^2\frac{G\,m_{obj1}}{r^3} \rightarrow \boxed{r = \frac{G\,M}{c^2}} \qquad [r] = \mathrm{m} \qquad (2.134)$$

Comparison: The solution for the field radius according to the Schwarzschild equation for a non-rotating black hole:

$$r_S = \frac{2\,G\,M}{c^2} \qquad (2.173)$$

Effect of the velocities on the gravitational force:

- ➔ The greater the magnitude *of* V_4, the stronger the effect of the gravitational force $F_{gravity}$ with its field between objects.
- ➔ The greater the magnitude *of* V_5, the further the fields of an object with its relativistic field radius $r(t)$ have an effect.

The **field radius *r*** describes the spatial range in which photons and other exchange particles can no longer avoid each other. A field exchange takes place between them. The field radius r of an object contributes to the volume space in space-time. The field radius is considered relativistically as $r(t)$. Its magnitude varies sinusoidally as a function of proper time t.

The **angular frequency *k*** is an invariant, non-relativistic reference value and specifies the cycle time of how often a field can be exchanged per second. The fixed angular frequency k is the reason for the correlation between an existing gravitational force and its space-time deformation.

The **wavelength *λ*** determines the spatial size of the field body in which the fields oscillate mathematically and periodically. The wavelength λ is the quotient of the maximum velocity $V_{max} = c$ and its **frequency *f***. The wavelength is considered relativistically with the gravitational red and blue shift.

From the perspective of the particle-field on a gravitational field, the surface gravity behaves like a kt - sinusoidal periodic gravitational field. It is registered as a **gravitational wave**, which is modelled in the wave-field. The angular frequency k represents the repetition of such a wave, while the time t describes the nominal time at the location of the inertial system. The sine function models the relativistic effects on an object. If only the maximum value is considered for the gravitational wave, which is repeated quickly, a source for a gravitational field is registered, from which a constant gravitational force emanates.

Mass-time constant and space-time constant relative to the inertial system:

The mass-time and space-time constants are characteristic constants for a 7-dimensional universe that define the property relationships between the various quantities (k – angular frequency, M – mass and r – field radius) independently of space-time mechanical effects. The mass-time constant describes the linear mass flow during a periodic cycle. In contrast, the space-time constant defines the linear relativistic increase of the field radius or the volume of space per second during a cycle. These constants describe not only the properties of the universe, but also all the objects in it. The constants result exclusively from the ratios of their sizes to each other. The nominal time t also links space and mass with the help of these constants.

$$G = 6{,}67\ 10^{-11}\,\mathrm{N}\frac{\mathrm{m}^2}{\mathrm{kg}^2}\ ;\ c = 299792458\ \frac{\mathrm{m}}{\mathrm{s}}$$

a) Space-time constant

$k_{Uni} \sim \dfrac{1}{r_{Uni}}$ A closed spherical universe requires precisely aligned universal constants so that a circular frequency k_{Uni} is exactly inversely proportional to the maximum volume radius R_{Uni} of the universe.

$$r_{Uni}\, k_{Uni} = \frac{G\, M_{Uni}}{c^2}\sqrt{\frac{G\, M_{Uni}}{r_{Uni}^3}} = \sqrt{\frac{(G\, M_{Uni})^3\,(c^2)^3}{(G\, M_{Uni})^3\,(c^2)^2}} = c$$

$$r_{Uni}\, k_{Uni} = r_{obj}\, k_{obj} = \text{constant} = c = 299792458\ \frac{\mathrm{m}}{\mathrm{s}} \qquad (2.174)$$

➔ The **space-time constant** is the product of the field radius r and the angular frequency k of an object.

b) Mass-time constant

$k_{Uni} \sim \dfrac{1}{M_{Uni}}$ During a period T, a mass M_{Uni} moves through space-time:

$$M_{Uni}\, k_{Uni} = M_{Uni}\sqrt{\frac{G\, M_{Uni}}{r_{Uni}^3}} = \sqrt{\frac{G\,(M_{Uni})^3\,(c^2)^3}{(G\, M_{Uni})^3}} = \sqrt{\frac{(c^2)^3}{(G)^2}}$$

$$M_{Uni}\, k_{Uni} = m_{obj}\, k_{obj} = \text{constant} = 4{,}0396\ 10^{35}\ \frac{\mathrm{kg}}{\mathrm{s}} \qquad (2.175)$$

➔ The **mass-time constant** is the product of the mass M and the angular frequency k of each object.

c) Mass-space constant

$$\frac{c}{r_{Uni}} = \frac{4{,}0396\ 10^{35}\ \frac{kg}{s}}{M_{Uni}} \quad \rightarrow \quad \frac{M_{Uni}}{r_{Uni}} = \frac{4{,}0396\ 10^{35}\ \frac{kg}{s}}{299792458\ \frac{m}{s}}$$

$$\boxed{\frac{M_{Uni}}{r_{Uni}} = \frac{m_{obj}}{R_{obj}} = \text{constant} = 1{,}34746\ 10^{27}\ \frac{kg}{m}} \qquad (2.176)$$

➔ The **mass-space constant** describes the directly proportional relationship between the event horizon or field radius of matter, depending on its mass.

The three constants form a closed, scalable triangle that applies to any mass *M* and any field radius *r* and clearly defines the circular frequency *k*.

The characteristic time of an object t_{Obj} is therefore the light travel time across its own field radius *r*.

$$T_{obj} = \frac{1}{k} = \frac{r_{obj}}{c}$$

Every scaled object has its own characteristic angular frequency *k*, which is determined exclusively by its field radius *r,* and vice versa. This explains why gravity is strong at close range and weak at a distance. Local high *k*-values with small field radii *r* lead to rapid oscillation, which averages out while the effective attraction remains intact. For large field radii *r* and small angular frequencies *k*, the global slow oscillation dominates, which modulates the range.

<u>Amount of force of the photon field against space-time:</u>

As the universe expands, a certain inertial force is at work, causing space-time to expand in a relativistic manner. The counterforce—the force of gravity—"holds" its mass within its space-time. The photon field in the universe thus exerts a constant force *F* on its quantized subspaces to prevent them from escaping its space-time. During the dynamic expansion of the universe, its relativistic unfolding of force is taken into account with *F*(*t*). This force is represented by the sinusoidal periodicity according to formula (2.164).

$$F_{gravity}(t) = \frac{G\ M_{Uni}\ m_{obj}}{r^2}\ \frac{1}{\sin(kt)} = m_{Obj}\ r_{obj}\ k_{obj}^2\ \frac{1}{\sin(kt)} = m_{obj}\ c\ k_{obj}\ \frac{1}{\sin(kt)}$$

Using the universal constants summarized above, the following holds:

$$F(t) = \{m_{obj}\ k_{obj}\}\ \{R_{obj}\ k_{obj}\}\ \frac{1}{\sin(kt)} = 4{,}0396\ 10^{35}\ \frac{kg}{s}\ 299792458\ \frac{m}{s}\ \frac{1}{\sin(kt)}$$

$$F(t) = 1{,}211\ 10^{44}\ \mathrm{N}\ \frac{1}{\sin(kt)} \tag{2.177}$$

The amount of inertial force required for a subspace to escape the universe's photon field must exceed $F_{Escape} > 1{,}211\ 10^{44}$ N. There is no quantized object at rest that could exceed this force. The universe itself already possesses this amount of force. It is conceivable that an additional dilative state—e.g., caused by object motion or plasma states—could introduce additional energy from outside the universe into a subspace. This could enable an escape. The universe itself does not provide this energy. Such an external source is conceivable but remains an open question until **Chapter 7.2**.

The relativistic force of the photon field at any point in space-time is determined by the quotient involving the sine function. This stabilizes the inertial dynamics globally.

The amount of $1{,}211\ 10^{44}$ N can be used as a universal reference for the consistency of particle characteristic calculations. This reference value is determined by universal constants for space-time and mass-time and scales across all orders of magnitude, from photons to black holes to the universe.