Chapter 7 Description of the Macrocosm using the Field-Space-Model

7.1 The Universal Photon – the Origin of a Universe

This chapter discusses a possible mechanism for the origin of a universe according to the FSM model. In the first step, the imaginary observer is enabled to examine his expanding universe backwards to its birth in order to find its origin. The processes from birth onwards are then examined in order to deepen our understanding. The model shown in **Figure 2.6** is used for the description.

Description of the universe at the location d$M(\alpha \rightarrow 0°)$ and –d$M(\alpha \rightarrow 180°)$:

The point where the wavelength λ_x of the universe coincides with the product of its field radius r_x and 2π is the starting point for the characteristic expansion as a universe in space-time. Once the field radius becomes greater than its own wavelength, the splitting of its 0-Spin momentum and the effect of its photon field in the particle-field $F_{1\text{-}3}$ begins.

G = 6,67 10^{-11} N$\frac{m^2}{kg^2}$; c = 299792458 $\frac{m}{s}$; $k_{Uni}\, M_{Uni}$ = 4,0396 10^{35} $\frac{kg}{s}$;
h = 6,626 10^{-34} Js

Planck's action quantum is calculated using formula (2.195):

$h = \lambda\, r\, m\, k$

If the wavelength λ_x is equal to the field radius 2π r_x, the following applies:

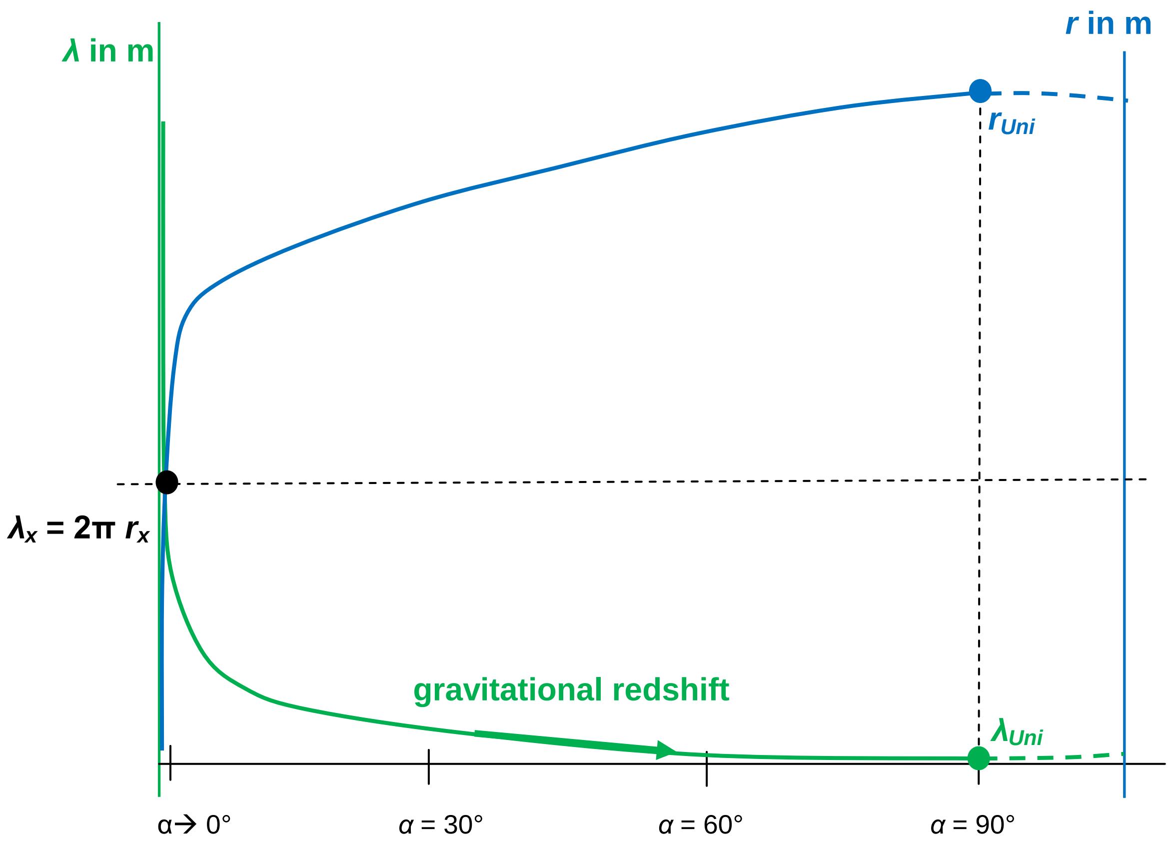
$h = \lambda_x\, r_x\, m\, k = 2\pi\, r_x^2\, m\, k$ with: $\lambda_x = 2\pi\, r_x$ (7.01)

$\underline{\underline{r_x = 1{,}616\ 10^{-35}\ \text{m}}}$

Comparison with Planck length l_p:

$l_p = \sqrt{\frac{h\, G}{2\pi\, c^3}}$ = 1,616 10^{-35} m

Figure 7.1 schematically shows the intersection of the relativistic wavelength and the relativistic field radius along the extension. The field radius of the universe continues with formula (2.134) up to its maximum value r_{Uni}, while the wavelength, from the perspective of the inertial system, undergoes a redshift according to formula (2.197) up to its minimum value λ_{Uni}.



Legend:

$\lambda(t) = \lambda_{Uni} \frac{1}{\sin(\alpha)}$ $\frac{\lambda_x}{2\pi} = 1{,}616\ 10^{-35}$ m λ_{Uni} = min. value

$r(t) = r \sin(\alpha)$ $r_x = 1{,}616\ 10^{-35}$ m r_{Uni} = max. value

Figure 7.1: Diagram of the expansion behaviour of the universe with its wavelength *λ* and its field radius *r*

Falling below the intersection point at the location near d*M*(*α* ≈ 0°):

Figure 7.1 shows the further course at the location with the field angle α ≈ 0° as soon as the value of the field radius $r(t)$ falls below its own wavelength $\lambda(t)$. The universe falls back into the characteristics of a photon. There is a size ratio between the wavelength and the field radius of a visible photon, which provides an indication of the circumstances under which the universe completely transitions to the characteristics of a photon. This is the location very close to dM($\alpha \approx 0°$).

<u>Example of a visible photon:</u>

λ_{pho} = 5,52 10^{-7} m ; $m_{pho} = \dfrac{h\,c^2}{G\,M_{obj}\,k_{obj}\,\lambda_{pho}}$ = 4,004 10^{-36} kg

$r_{pho} = \dfrac{G\,m_{pho}}{c^2}$ = 2,9715 10^{-63} m

The ratio between wavelength and field radius is:

$$\lambda_{pho} = r_{pho} Y \qquad (7.02)$$

$Y = \dfrac{r_{pho}}{\lambda_{pho}} = \dfrac{2{,}9715\ 10^{-63}\ \text{m}}{5{,}52\ 10^{-7}\ \text{m}} = 5{,}38\ 10^{-55}$ → Order of magnitude approx. 10^{-55}

Applying the order of magnitude evenly distributed over the wavelength and field radius, the following ratios for the universe result:

$\underline{\underline{r_Y =}}$ 1,616 10^{-35} m · 5,38 10^{-27} = $\underline{\underline{8{,}7\ 10^{-62}\ \text{m}}}$ (estimate)

$\underline{\underline{\lambda_Y =}} \dfrac{2\pi\ 1{,}616\ 10^{-35}\ \text{m}}{5{,}38\ 10^{-28}} = \underline{\underline{1{,}9\ 10^{-7}\ \text{m}}}$ (estimate)

This makes the field angle *α* even smaller and brings it closer to zero:

$$r_Y\, k_{Uni} = c \sin(\alpha) \qquad (7.03)$$

At the location dM($\alpha \approx 0°$), the minimum state of expansion is reached. From this order of magnitude for the wavelength and field radius, the universe transitions to the characteristics of a photon with mass M_{Uni}. Photons can overlap as electromagnetic oscillations. In this way, the universe could be absorbed into a higher structure as a photon through interference. This higher structure is called **the Universal Photon**. In this way, a universal photon can conversely expend part of its energy to create a photon that can form itself into a universe. The creation of such a photon is already the birth of the universe.

In the FSM model, there is no absolute state of singularity, but rather an approximation until the photon properties of the universal photon are reached.

Representation of the birth phase of the universe in field-space:

Starting from the universal photon, which a photon generates from its own wave structure, important characteristics for dimensioning the universe are defined. There is a fixed relationship between the gravitational constant G and the maximum speed $V_{max} = c\ (= k\ r)$, which generate the mass-time and space-time constants. With a certain mass M_{Uni}, Planck's quantum of action h automatically creates the ratio of an oscillation for a certain circular frequency k and field radius r, that all define the circumference of the universe and its period. The reciprocal of the fine-structure constant, α, determines the point at which an interaction between photons begins.

Initially, the universe exists as a photon with a wavelength of $\lambda_Y \approx 1{,}9\ 10^{-7}$ m and a corresponding field radius of approximately $r(t) = 8{,}7\ 10^{-62}$ m as part of the universal photon. The photon receives a spin-0-impulse P from the universal photon in the wave-field $F_{4\text{-}6}$ with $0 = P_{pos} - P_{neg}$. According to the field angle $\alpha \approx 0°$, the photon is almost completely orthogonal to the dimension plane D_{56} in accordance with its space-time deformation. Its field deformation is also maximally contracted. The photon has restructured itself throughout the entire field-space into an invisible photon according to the photon model **in Chapter 2**. For the invisible photon, this is the state in space-time in which the space-time-mechanical effects, with their gravitational potential dM(α), interact most strongly with their counteracting forces.

The equation $c^2 = V_5^2 + V_4^2$ introduces the field propagation velocities V_4 and V_5, which describe the field deformation and space-time deformation, thereby causing the field angle α to oscillate dynamically. According to formula (2.177), the photon, as a primordial universe, possesses a relativistic inertial force of $F(t) = 1{,}211\ 10^{44}\ \text{N}\ \dfrac{1}{\sin(kt)}$, which, in the range $0° < kt = \alpha < 90°$, reduces the space-time mechanical forces inversely proportional to the sine of the high field angle α. This occurs by increasing its field radius and distributing its momentum across smaller wavelength partitions within the available volume. The excess energy $E(\alpha < 90°)$ is thus converted into volume. Its global potentials are distributed across the divided wavelength partitions and decrease accordingly.

$$E(\alpha) = \frac{r_{Uni}\ h\ c}{r(t)\ \lambda_{Uni}} = \frac{h\ c}{\lambda_{Uni}} \frac{1}{\sin(\alpha)} \qquad (7.04)$$

In **Figure 7.2,** the two partial photons, each with a spin of 1 and a partial momentum, represent the universe at that primordial moment, as soon as the state $2\pi\ r_x = \lambda_x$ is reached. The field radius and the wavelength now have the same size $r_x = 1{,}616\ 10^{-35}$ m. The space-time deformation, through the global field angle α, forces both impulses to be orthogonal to the dimensional plane D_{56}. Through the rotation of two partial pulses with spin 1, one above and one below the dimension plane D_{56}, the photon field forms its electric voltage potential. The photonic separation would be comparable to two charged capacitor plates. Due to the time-dependent expansion of the electromagnetic photon field, the variable voltage potential acts like a displacement current with its orthogonally aligned magnetic field. In the wave-field $F_{4\text{-}6}$, the displacement current generates an electric field effect parallel to the fourth spatial dimension D_{4}. The electrostatic separation occurs through the dimension plane D_{56}. In the initial stage of the universe, the electric potential (like the gravitational potential) is at its maximum and tends towards its minimum until it reaches its maximum expansion.

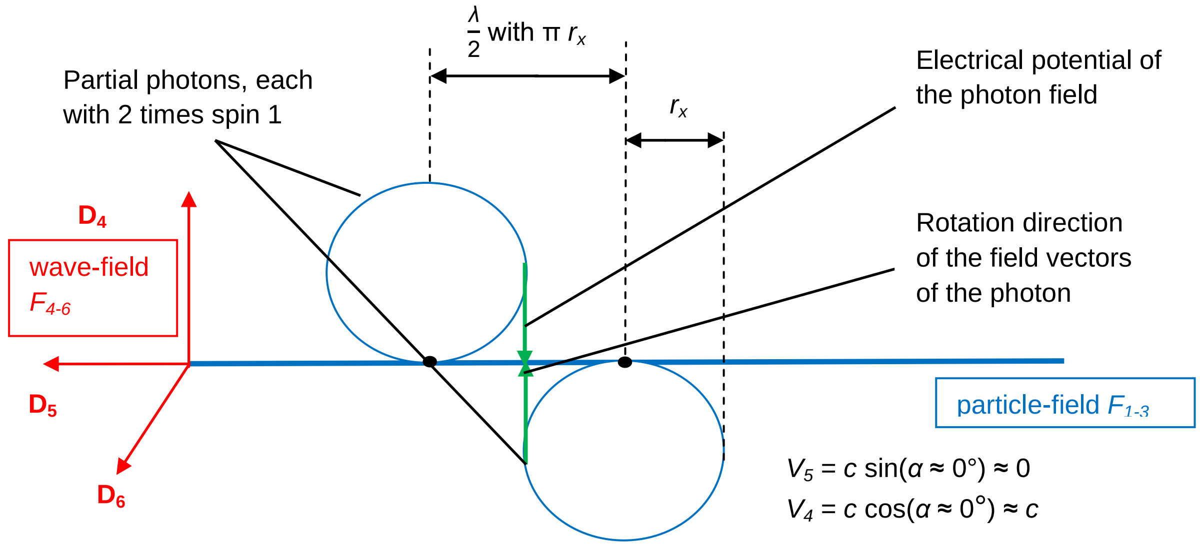


Figure 7.2: Shows the universe as an invisible photon after the separation of its momentum

Only when the field radius $r(t)$ exceeds $\lambda(t)$, the wavelength of the photon, does the photon become a universe. At exactly this moment, the universe with the particle-field $F_{1\text{-}3}$ becomes a 6-dimensional extension of the field-space. It seems reasonable to assume that this process takes place within an infinitesimally short period of time.

The spatial expansion $r(t)$ now exceeds r_x. With the continuous expansion of the universe, the influence of the field propagation velocity V_5 begins to increase. The expansion of the universe leads to the following dynamics: $V_4 \approx (c \rightarrow 0)$; $V_5 \approx (0 \rightarrow c)$.

Meanwhile, the original photon field continues to divide into smaller photon partitions, subject to the conservation of momentum. The next division only occurs when the wavelength of the universe λ_{Uni} fits twice into its current field radius $r(t)$, and so on.

During the expansion of the universe, the quantity of partitioned fields of all particles corresponds to the original electromagnetic photon field. It follows that each photon, as a space-time quantum with its field radius and mass, also contributes to the surrounding space-time and to the total mass of the universe.

The angular momentum of the universe remains constant for its quantised partitions with the order of magnitude of Planck's quantum of action h for a full arc measure with 2π. As a result of its dynamic expansion, the field-space fills with a growing quantity of invisible photons, fions and visible photons of different frequencies until its potential forces are exhausted at maximum expansion across space-time.

With its global expansion, the universe continuously forms from an orthogonal to a parallel shape to the dimensional plane D_{56}.

The metric component is:

$ds^2 \supset [1 + \cos(k_{Uni}\, t)]$

Figure 7.3 shows the state of the universe at the location dM(α = 90°) based on its size at the location dM($\alpha \approx$ 0°). Note the space dimensions shown, which are rotated by 90° compared to **Figure 7.2**. The small circles represent all photons in the universe, which have been divided into half-integer multiples via the momentum.

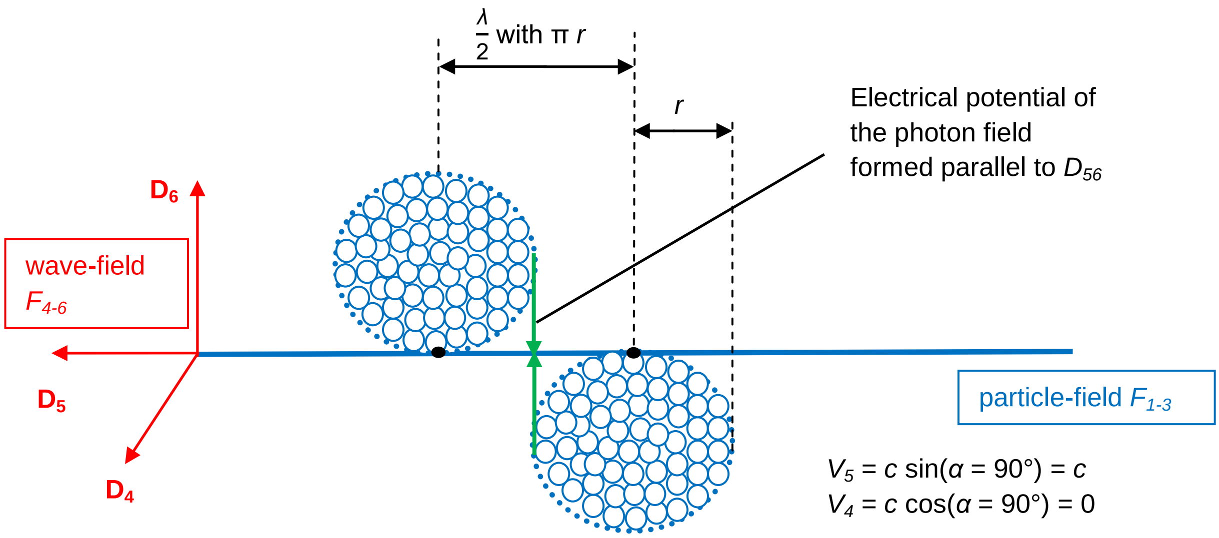


Figure 7.3: The hypothetical change in the universe over the spatial extension, parallel to the dimension plane D_{56}

At the end of the spatial expansion at the location dM(α = 90°), all invisible photons have transitioned into visible photons and propagate in the surrounding space at a maximum speed $V_{max} = V_5 = c$. Fions are merely an intermediate stage between the state of the invisible photon and the visible photons at the end of this development.

Relationship between wavelength and field radius for a universe and a photon:

Photon: field radius ≤ wavelength

Universe: field radius > wavelength

7.2 Space-time characteristics of the Universe

In order to enable a calculation example for the various size ratios, the mass of the universe M_{Uni} must be defined as the input variable.

Determination of the mass of the universe M_{Uni}:

So far, only the visible mass of the universe can be observed. In reality, this would probably be greater if a mass determination were carried out from different positions in the universe. The data is constantly being updated. The visible mass of the universe is given in the literature as 10^{53} kg. According to the literature, it is also assumed that dark energy currently accounts for 68% of the total mass. For this example, let us assume that the value for dark energy from the literature corresponds to the invisible photons according to FSM. This leaves 32% for visible and hidden particles.

$M_{visible\_Uni} = 10^{53}$ kg; $G = 6{,}67\ 10^{-11}\ \text{N}\frac{\text{m}^2}{\text{kg}^2}$; $c = 299792458\ \frac{\text{m}}{\text{s}}$;

$h = 6{,}626\ 10^{-34}$ Js ; $k_{Uni}\ M_{Uni} = 4{,}0396\ 10^{35}\ \frac{\text{kg}}{\text{s}}$; $M_{dark\_energy} = 68\%\ M_{Uni}$

In the particle model of the FSM, 15 x 4-dimensional rotational orbits are possible. Most particles are constructed with four such rotational orbits for the proton and neutron. Only a few particles, such as the Z-, W- or H-bosons, require five rotational orbits.

$\frac{4}{15} = 26{,}66\%$ of visible particles correspond to a ratio of 1: 2,75 to hidden particles

The distribution of mass in the universe is as follows:

visible particles: $\frac{4}{15}\ 32\% \approx 8{,}5\%$ hidden particles: $\frac{11}{15}\ 32\% \approx 23{,}5\%$

Dark energy = total number of all invisible, uncoupled photons ≈ 68%

The distribution of mass fractions relative to the already visible mass is as follows:

$M_{visible\_particles} = 10^{53}$ kg $M_{hidden\_particles} = \frac{23{,}5\%}{8{,}5\%}\ 10^{53}\ \text{kg} = 2{,}765\ 10^{53}$ kg

$$M_{invisible\_photons} = \frac{68\%}{8{,}5\%}\ 10^{53}\ \text{kg} = 8\ 10^{53}\ \text{kg}$$

$$\underline{\underline{M_{Uni}}} = 10^{53}\ \text{kg} + 2{,}765\ 10^{53} + 8\ 10^{53} = \underline{1{,}1765\ 10^{54}\ \text{kg}}$$

Maximum radius of the universe:

The field radius *r* contributes to the spatial extent. *r*(*t*) corresponds to the relativistic field radius. To obtain a manageable result, the following results are given in orders of magnitude of billion light years (LY).

$$r = \frac{G\,M}{c^2} \qquad (2.134)$$

$$\underline{\underline{r_{Uni}}} = \frac{G\,M_{Uni}}{c^2} = \underline{\underline{8{,}73125\ 10^{26}\ \mathrm{m} \approx 8{,}73\ 10^{26}\ \mathrm{m}}} \qquad (7.05)$$

$\underline{\underline{r_{Uni} \approx 92{,}35 \text{ billion LY}}}$

Wavelength of the universe:

For $\alpha = 90°$:

$$\underline{\underline{\lambda_{Uni}}} = \frac{h\,c^2}{G\,M_{Uni}^2\,k_{Uni}} = \underline{\underline{1{,}87861\ 10^{-96}\ \mathrm{m}}} \quad \text{relativistic: } \lambda(t) = \lambda_{Uni}\,\frac{1}{\sin(\alpha)} \qquad (7.06)$$

$r_{Uni} = 8{,}73125\ 10^{26}$ m $\approx 8{,}73\ 10^{26}$ m   relativistic: $r(t) = r_{Uni}\,\sin(\alpha)$

Field angle *α* at location with a wavelength of λ_x:

$$\frac{h\,c^2}{G\,M_{Uni}^2\,k_{Uni}}\,\frac{1}{\sin(\alpha)} = \frac{G\,M_{Uni}}{c^2}\,\sin(\alpha)\ 2\pi$$

$$\sin(\alpha) = \sqrt{\frac{h\,c^4}{2\pi\,G^2\,M_{Uni}^3\,k_{Uni}}} \quad \rightarrow \quad \alpha = \sin^{-1}\left(\sqrt{\frac{h\,c^4}{2\pi\,G^2\,M_{Uni}^3\,k_{Uni}}}\right) \qquad (7.07)$$

$\underline{\underline{\alpha \approx 1{,}0603\ 10^{-60}°}}$

Alternatively:

$$\alpha = \sin^{-1}\left(\frac{r_x}{R_{Uni}}\right) \qquad (7.08)$$

$$\alpha = \sin^{-1}\left(\frac{1{,}616\ 10^{-35}\ \mathrm{m}}{8{,}73125\ 10^{26}\mathrm{m}}\right)$$

$\underline{\underline{\alpha \approx 1{,}0604\ 10^{-60}°}}$

- ➔ The mass of the measured visible universe in relation to all invisible photons is confirmed with only a slight deviation.
- ➔ The FSM results for determining the mass of the universe are almost completely consistent with astronomical observations.

Field angle *α* at the location where dark energy begins to couple:

The event horizon with the field radius r_e is equal to the radius of the electron Re with the reciprocal factor of 137 at this location.

$$\alpha = \sin^{-1}\left(\frac{\lambda_e}{2\pi \cdot 137 \cdot R_{uni}}\right) \qquad (7.09)$$

$$\alpha = \sin^{-1}\left(\frac{r_e}{R_{uni}}\right) \qquad \text{with } r_e = 2{,}82\ 10^{-15}\ \text{m}$$

With the expansion beginning at r_e, the universe starts to electrically couple its invisible, uncoupled energy with the slightest excitation.

$$\alpha = \sin^{-1}\left(\frac{2{,}4263\ 10^{-12}\ \text{m}}{2\pi \cdot 137 \cdot 8{,}73125\ 10^{26}\text{m}}\right)$$

$$\underline{\underline{\alpha \approx 1{,}85\ 10^{-40\circ}}}$$

Circumference *U* of the universe:

$$U_{Uni} = 2\pi\, r_{Uni} \qquad (7.10)$$

$\underline{\underline{U_{Uni} =}}\ 2\pi\, r_{Uni} \approx \underline{\underline{580{,}3 \text{ billion LY}}}$ is the time required for light to circle the universe at maximum expansion

Circular frequency of one period:

$$k = \sqrt{\frac{G\,M}{r^3}} \qquad (2.135)$$

$\underline{\underline{k_{Uni} =}} \sqrt{\frac{G\,M_{Uni}}{r_{Uni}^3}} \approx \underline{\underline{3{,}4336\ \ 10^{-19}\ \frac{1}{s}}}$ → k corresponds to the circular frequency of the universe

$$T_{2\pi} = \frac{1}{k} \qquad (7.11)$$

$\underline{\underline{T_{2\pi} =}} \frac{1}{k} \approx \underline{\underline{92{,}35 \text{ billion years}}}$ for one complete period T

Time until maximum expansion of the universe:

The maximum expansion is already reached after $\frac{\pi}{2}$ or after $\frac{1}{4}$ of a full period T.

$$\underline{\underline{T_{expansion,max.} =}} \frac{T}{4} = \frac{92{,}35 \text{ billion Y}}{4} = \underline{\underline{23{,}09 \text{ billion years}}}$$

Determination of the current field angle *α* using the mass distribution:

Birth of the universe	Current expansion	At the end of expansion
$M_{invisible\_photons}$ = 100%	$M_{invisible\_photons}$ = 68%	$M_{invisible\_photons}$ = 0%
$M_{hidden\_particle}$ = 0%	$M_{hidden\_particle}$ = 23,5%	$M_{hidden\_particle}$ = 73,33%
$M_{visible\_matter}$ = 0%	$M_{visible\_matter}$ = 8,5%	$M_{visible\_matter}$ = 26,66%

Visible matter currently accounts for 8,5% of the total mass. When the universe is almost completely expanded, it can be assumed that the ratio between visible and hidden particles will remain the same during their transformation from invisible photons. Thus, the proportion of the total mass of the universe is infinitesimally close to the end of the maximum expansion for visible matter at 26,66% and for hidden particles at 73,33%. Based on a mass fraction of 26,66% after 100% development, the current field angle *α* corresponds to the mass fraction of 8,5% at the location of the current expansion.

$$\underline{\underline{\alpha =}} \sin^{-1}\left(\frac{8{,}5\%}{26{,}66\%}\right) \approx \underline{\underline{18{,}7°}}$$ → current field angle *α* of the universe

Similarly, the field angle *α* could be calculated based on the amount of matter already coupled relative to the total amount.

$$\underline{\underline{\alpha =}} \sin^{-1}\left(\frac{32\%}{100\%}\right) \approx \underline{\underline{18{,}7°}}$$ → alternatively

The curve for the amount of available dark energy shows a dynamic sinusoidal pattern. The expansion of the universe with its potential energy and the decrease in the amount of invisible energy are complementary to each other. However, the time interval of a measurement could be so small that only the accelerated expansion of the universe is detected, but not the decrease in the amount of invisible energy. Ultimately, the more accurate the astronomical data on the mass ratio between dark energy and visible mass, the more precisely the current field angle *α* of the universe and thus its field radius *r* can be determined.

Relativistic energy increase of the universe at the current field angle *α*:

The relativistic energy increase was derived in **Chapter 2.2, Point 10** and represented by formula (2.101):

$$E(\alpha) = h\, f_{obj} \frac{1}{\sin(\alpha)} = m_{Obj}\, c^2 \frac{1}{\sin(\alpha)} \quad \text{with: } \alpha = kt$$

→ relativistic energy increase for accelerated objects

$$\underline{\underline{E_{visible\_matter}(t)_{\alpha}}} = M_{visible\_matter}\, c^2 \frac{1}{\sin(\alpha = 18{,}7°)} = \underline{\underline{2{,}8\ 10^{70}\ J}} \quad (7.12)$$

→ energy fraction of visible matter

$$\underline{\underline{E_{hidden\_matter}(t)_{\alpha}}} = M_{hidden\_Matter}\, c^2 \frac{1}{\sin(\alpha = 18{,}7°)} = \underline{\underline{7{,}75\ 10^{70}\ J}}$$

→ energy content of hidden particles (dark matter)

$$\underline{\underline{E_{invisible\ photons}(t\ )_{\alpha}}} = M_{invisible\_photons}\, c^2 \frac{1}{\sin(\alpha = 18{,}7°)} = \underline{\underline{2{,}24\ 10^{71}\ J}}$$

→ energy content of all invisible photons (dark energy)

$$\underline{\underline{E_{total}(t)_{\alpha}}} = M_{Uni}\, c^2 \frac{1}{\sin(\alpha = 18{,}7°)} = \underline{\underline{3{,}3\ 10^{71}\ J}}$$

→ energy contribution from the quantities of visible matter, hidden particles and invisible photons

$$\underline{\underline{E_{total}(t)_{\alpha}}} = M_{Uni}\, c^2 \frac{1}{\sin(\alpha = 90°)} = \underline{\underline{1{,}057\ 10^{71}\ J}}$$

The relativistic energy increase occurs as long as the universe is exposed to the compensating forces of space-time with a field angle $\alpha \neq 90°$ or 270°. The universe must therefore perform additional work in order to expand against the compensating forces. The energy required decreases with expansion and is dynamically converted into space volume relative to the inertial system according to a sine function.

Current radius *r*(*t*) of the universe:

$$\underline{\underline{r(t)_{18,7°}}} = r_{Uni} \sin(\alpha) = 92{,}35 \text{ billion LY} \cdot \sin(18{,}7°) = \underline{\underline{29{,}608 \text{ billion LY}}}$$

Current age of the universe :

$$T_{2\pi} = \frac{1}{k} \approx 92{,}35 \text{ billion years}$$ → complete period

$$T_{0,5\pi} = \frac{1}{4k} \approx 23{,}0875 \text{ billion years}$$ → one quarter period

$$\underline{\underline{t(\alpha)}} = \frac{1}{4k} \sin(18{,}7°) \approx \underline{\underline{7{,}402 \text{ billion years}}}$$ → to the current field angle $\alpha = 18{,}7°$

Remaining time of the attractive time of the universe:

$\frac{7{,}402 \text{ bill.Y}}{23{,}0875 \text{ bill.Y}} 100\% = 32{,}06\%$ → Attractive time already elapsed from $\frac{1}{4k}$

$\Delta t_{expansion}$ = 23,0875 billion years – 7,402 billion years

$\Delta t_{expansion}$ = 15,6855 billion years → remaining time suitable for life

Trigonometric distance *b(t)* for the decrease in field potential:

bt) trigonometrically describes the remaining distance of the field angle α between d$M(\alpha)$ and d$M(90°)$ until it reaches its maximum at $\alpha = 90°$:

$$b(t) = r_{Uni} \cos(\alpha) \tag{7.13}$$

with: r_{Uni} = 92,35 bill. LY ; $\alpha = 18{,}7°$

$b(t) = r_{Uni} \cos(\alpha)$ = 92,35 bill. LY · cos(18,7°)

$b(t)$ = 87,47 billion LY → Potentially still hidden depth of the observable light at the location of the gravitational potential d$M(\alpha = 18{,}7°)$ until the gravitational force with the field angle α at $\alpha = 90°$ becomes minimal. It can be seen that, depending on the time dilation effect of light during the expansion of the universe, only part of the light will be visible to the observer.

Maximum and current field propagation velocity V_4 and V_5:

The field propagation velocity V_5 corresponds exactly to the maximum velocity $V_{max} = c$ when the space-time mechanical effects on the Lorentz factor 1 have adjusted to the maximum expansion of the universe:

$$V_{5\_max} = c \sin(90°) = 299792458 \, \frac{\text{m}}{\text{s}}$$

with: $\alpha = 90°$

Current field propagation velocity V_5 and V_4 in the field-space at the location of the current field angle α:

$$V_5 = c \sin(18{,}7°) = 96117356{,}5 \, \frac{\text{m}}{\text{s}}$$

$$V_4 = c \cos(18{,}7°) = 283966497{,}5 \, \frac{\text{m}}{\text{s}}$$

Current spatial expansion velocity of *r'*(*t*):

$$r'(t) = \sqrt{c^2 - b'(t)^2} = \sqrt{c^2 - c^2 \sin^2(\alpha)} = c \cos(\alpha) \tag{7.14}$$

note: 1. Derivation of cos(α)

$\underline{\underline{r'(t) =}}$ $c \cos(18{,}7°) = \underline{\underline{283966497{,}5 \frac{m}{s}}}$ → The space expansion velocity relative to the volume radius $r(t)$ is equal to the current field propagation velocity V_4 and decreases continuously over the course of the cosine function to the maximum expansion with $\alpha = 90°$. During the early stages of the universe, the expansion of space is faster than V_5 at the field propagation speed V_4. This phenomenon turn around with the field angle from $\alpha = 45°$.

Current velocity of *b'*(*t*) at location *α* = 18,7°:

$$b'(t) = \sqrt{c^2 - r'(t)^2} = \sqrt{c^2 - c^2 \cos^2(\alpha)} = c \sin(\alpha) \tag{7.15}$$

note: 1. Derivation of sin(*α*)

$\underline{\underline{b'(t) =}}$ $c \sin(18{,}7°) = \underline{\underline{96117356{,}5 \frac{m}{s}}}$ → The velocity relative to the path $b(t)$ is equal to the current field propagation velocity V_5 and allows the telescopes to peer deeper and deeper into the universe at ever-increasing speeds. It increases continuously with the course of the sine function until it reaches its maximum at $c \sin(\alpha = 90°)$. The assumption that the universe is expanding faster and faster with $r'(t)$ is therefore a fallacy, because it is the measured speed of light V_5 that continues to increase. The field propagation speed V_4, on the other hand, decreases with the expansion of space $r(t)$ with the cosine function. The standard model assumes a multiple of the speed of light to explain the accelerated expansion of space in the universe. Objects moving faster than the maximum speed $V_{max} = c$ already contradict the special theory of relativity. In contrast to the standard model of the universe, the FSM explains that the maximum speed of light *c* is not reached during the expansion phase and thus describes a conformal expansion characteristic of the universe.

Distance *w*(*t*) already travelled by visible light :

The relativistically travelled distance $w(t)$ takes into account the contraction dynamics of the speed of light V_5 at all expansion locations in the universe. This corresponds to the information about the visible depth of the universe that telescopes actually register.

$$w(t) = r_{Uni} (1 - \cos(\alpha)) \tag{7.16}$$

with: $w(t)_{measured}$ = 13,8 billion LY; r_{Uni} = 92,35 billion LY; $\alpha = 18{,}7°$

$\underline{\underline{w(t) =}}$ 92,35 Mrd. LY · (1 - cos(18,7°)) = $\underline{\underline{\text{4,875 billion LY}}}$ → Current visibility of the universe

With a lifetime of 7,402 billion years, the universe has expanded to a volume radius of 29,608 billion LY, but its light could travel only a relativistically distorted distance of at most 4.875 billion LY at the relativistic speed $b'(t)$. This confirms the above statement that the universe is currently expanding significantly faster than light can travel through it.

Object time of a <u>moving object</u> relative to a stationary object:

Due to the periodic expansion of the universe, which follows its own object time, its ageing behaviour also changes during expansion. The universe ages with its expansion as a function of time dilation. This corresponds to previous calculations that telescopes can see deeper and deeper into space at ever-increasing speeds.

$$\left\{\frac{c}{\sqrt{c^2 - r'(t)^2}}\right\}_{\alpha=18,7°} = \left\{\frac{c}{\sqrt{c^2 - V_4{}^2}}\right\}_{\alpha=18,7°} \tag{7.17}$$

$$\left\{\frac{c}{\sqrt{c^2 - V_4{}^2}}\right\}_{\alpha=18,7°} = \left\{\frac{299792458\,\frac{m}{s}}{\sqrt{\left(299792458\,\frac{m}{s}\right)^2 - \left(283966497,5\,\frac{m}{s}\right)^2}}\right\}_{\alpha=18,7°} = \frac{299792458\,\frac{m}{s}}{96117356,5\,\frac{m}{s}}$$

Alternative:

$$\left\{\frac{c}{\sqrt{c^2 - r'(t)^2}}\right\}_{\alpha=18,7°} = \frac{c}{V_5} = \frac{1}{\sin(\alpha = 18,7°)} \tag{7.18}$$

$\frac{1}{\sin(\alpha = 18,7°)} \approx \underline{\underline{3,12}}$ → Time dilation in the snapshot

<u>Cross-check at location d$M(\alpha = 18,7°)$:</u>

c = factor for time dilation $\cdot V_5 \approx 3,12\ V_5 \approx 3,12 \cdot 96117356,5\,\frac{m}{s} = 299792458\,\frac{m}{s}$

Circumference $U_{t\_universe\_\alpha}$ at point α = 18,7°:

$$U_{t\_Uni\_18,7°} = 2\pi\, r_{space\ expansion\_18.7°} \tag{7.19}$$

$U_{t\_Uni\_18,7°} = 2\pi \cdot$ 29,608 billion LY = 186,03 billion LY

With a time dilation factor of 3,12:

$$U_{t\_Uni\_\alpha} = 2\pi\, r_{space\ expansion\_\alpha\_in\_billion\ LY} \cdot \text{time dilation factor} \tag{7.20}$$

with: $[U_{t\_Uni\_\alpha}]$ in billion LY

$U_{t\_Uni\_18,7°} \approx 2\pi \cdot$ 29,608 billion LY $\cdot$ 3,12

<u>$U_{t\_Uni\_18,7°} \approx$ 580,3 billion LY</u> (see also orbit at position $\alpha = 90°$)

➔ A field emission with velocity V_5 always requires the same time to orbit the universe at all locations with gravitational potential d$M(\alpha)$, taking into account time dilation. This alternatively explains the prospective trajectory curve from **Figure 2.6**.

Relativistic course of some parameters depending on the field angle *α*:

Increase in coupled matter: $\text{matter}_{\%} = \sin(\alpha)$ (2.99)

Decrease in dark energy: $\text{dark energy}_{\%} = 1 - \sin(\alpha)$

Energy: $E_{total,\alpha} = M_{Uni}\, c^2 \frac{1}{\sin(\alpha)}$ with: $M_{Uni} = 1{,}1765\ 10^{54}$ kg; $c = 299792458\ \frac{m}{s}$

Age of the universe: $t(\alpha) = \frac{1}{4k} \sin(\alpha)$ with: $\frac{1}{4k} = 23{,}0875$ billion years

Radius of the universe: $r(t) = r \sin(\alpha)$ with: $r = 92{,}35$ billion LY

Path of light: $w(t) = (1 - \cos(\alpha))\, r$ with: $r = 92{,}35$ billion LY

Time dilation factor: $\frac{1}{\sin(\alpha)}$ with: $r = 1$; $c = 1$

Factor for relative energy increase: $\frac{1}{\sin(\alpha)}$ with: $r = 1$; $c = 1$

α	**0,57**	**2,87**	**5,74**	**14,5**	**18,7**	**30**	**44,43°**	**64,1**	**81,9**	**89,7**
Dark Energy	99%	95%	90%	75%	68%	50%	30%	10%	1%	0,001%
Matter	1%	5%	10%	25%	32%	50%	70%	90%	99%	99,99%
Energy in J	$1{,}06\ 10^{73}$	$2{,}11\ 10^{72}$	$1{,}06\ 10^{72}$	$4{,}22\ 10^{71}$	$3{,}3\ 10^{71}$	$2{,}11\ 10^{71}$	$1{,}51\ 10^{71}$	$1{,}17\ 10^{71}$	$1{,}07\ 10^{71}$	$1{,}06\ 10^{71}$
Age in billion years	0,23	1,15	2,31	5,78	7,4	11,5	16,16	20,77	22,86	23,08
Radius in billion LY	0,92	4,625	9,25	23,13	29,61	46,2	64,65	83,05	91,45	92,345
Path *w* in billion LY	$4{,}57\ 10^{-3}$	0,116	0,463	2,94	4,875	12,4	26,4	52	79,35	91,85
$\frac{1}{\sin(\alpha)}$	100	20	10	4	3,12	2	$\approx \sqrt{2}$	1,11	1,01	1,00001

Table 7.1: Dynamics of various variables as a function of the field angle *α*

α	V_5 in $\frac{m}{s}$	$\frac{1}{\sin(\alpha)}$	V_4 in $\frac{m}{s}$	$\frac{1}{\cos(\alpha)}$
0°	0	∞	299792458	1
1°	5232100	57,3	299746798	1,00015
10°	52058414	5,76	295237937	1,015
18,7°	96117356	3,12	283966497	1,056
30°	149896229	2	259627885	1,55
45°	211985280	$\sqrt{2}$	211985280	$\sqrt{2}$
60°	259627884	1,155	149896229	2
88°	299609832	1,00061	10462605	28,65
90°	299792458	1	0	∞

Table 7.2: Effect of the field angle α on the field propagation velocities V_5 and V_4; Yellow: fictitious singularity situation; Orange: current situation; Red: interface between V_5 and V_4; Green: location of the inertial system with $V_5 = c$

These values fit together very well, because as the field angle α increases, the object time also changes in such a way that the spatial expansion with decreasing gravitational potential of d$M(\alpha \rightarrow 90°)$ relative to an object with mass m_{obj} follows the sine periodicity. Consider the value of α, which is initially $\alpha = 18{,}7°$, but already accounts for 32% of the age and radius of the universe relative to $\alpha = 90°$, until the maximum expansion is reached. The expansions speed of the universe $r'(t)$ decreases with the increase of the cosine. However, the trigonometric path $w(t)$ from the signal point with the source at location $r(\sim 0)$ to the object continues to accelerate until the maximum expansion with $r(\alpha = 90°)$ is reached, see **Table 7.2.** The remaining field angle α with the distance $b(t)$ accelerates until the velocity $b'(t) = c \sin(\alpha = 90°)$ is reached. Classically, this distance of the visible light with $w(t)$ is interpreted as being related to the current radius of the universe $r(t)$ with increasing distance. This is only the case in the initial and final states in all directions of the mathematical hollow sphere shape. The dynamic change of $r(t)$ as the volume radius of the universe is described by $r'(t) = V_4$ relative to the field propagation speed V_5. The spatial expansion with $r'(t) = V_4$ is currently faster than the field propagation speed V_5. The ratio is specifically:

$$\frac{V_4}{V_5} = \frac{283966497\,\frac{m}{s}}{96117356\,\frac{m}{s}} \approx 2{,}95 \qquad (7.21)$$

Quantised matter currently interacts with 2,95 times the force of gravity instead of following the expansion of the universe. This is why two galaxies can meet at a 90° angle when they should be moving away from each other. This dynamic rotates from the field angle $\alpha = 45°$. Within the field angle $45° < \alpha < 90°$, galaxies will increasingly follow the expansion of space in the universe as the gravitational force between objects decreases in relation to the diminishing gravitational potential. This also means that the distribution of galaxies in volume space is completed more and more quickly in accordance with the sine function.

It can be seen for the first quarter period that, with a possible travel time of approximately 23,1 billion years, light will not consistently reach the radius of 92,35 billion light years. This is due to two factors. The first is that, at the beginning of its expansion, the universe expands faster than light through the cosine function with the field propagation speed V_4 than light could propagate at the speed of light $V_5 = c\,\sin(\alpha)$. This only turn around with the field angle of $\alpha = 45°$. The second factor is that the light cannot make up for the time lost due to the space it has already travelled with increased time dilation, until it reaches its maximum expansion with minimal time dilation. This means that the observer will only ever be able to see a section of the universe, even if this section becomes larger and larger as the universe expands. The observer will always lack information about the observable depth, the mass of the visible universe or our position in the universe. A concrete indication of this is that the visible universe is currently 7,4 billion light years old, the volume radius of the expansion is 29,608 billion light years, and yet the observer only registers a viewing distance of 4,875 billion light years with telescopes. If the current time dilation is taken as 3,12, the telescopes would theoretically be able to register a non-space-time-distorted depth of 3,12 · 4,875 billion light years, or 15,21 billion light years. The observed light does not take into account the dynamic development of its propagation speed $\beta'(t)$ nor the physical limit at which the measurable gravitational redshift produces wavelengths that are too long for detection.

The realisation that only a small section of the universe can be seen by observers measuring from Earth suggests that telescopes only measure the most distant celestial bodies in different stages of development. The idea that we are standing in the centre of the universe on Earth and therefore measure the same distance in all directions seems extremely unlikely at first glance. On the contrary, using the FSM model, it would even be possible to determine our own approximate position in the universe by triangulating the measured gravitational redshift along the entire spherical sector. The determination of the visible mass of the universe and its almost exact confirmation by the field angle α in the state $r_x = \lambda_x$ suggests that our position in the universe must already be very close to the centre of the spherical sector.

The cosine-shaped field forces over the path $b(t)$ with $\cos(\alpha)$ at the maximum expansion height mathematically obtain a negative sign from the field angle $\alpha > 90°$. This is obviously due to the change in direction of the field propagation velocity V_4, which points in the opposite direction from $\alpha > 90°$. To do this, simply continue the development of the field propagation velocities of V_4 and V_5 from **Figure 2.6**. The repulsive forces begin with along the way $- b(t)$ at the location $dM(90° < \alpha < 270°)$.

Furthermore, it must be noted that, starting from an expansion of the universe with the field angle $\alpha > 90°$, the spatial density increases again and the period continues to move towards the repulsive component of the next Big Bang stage $-dM(\alpha \approx 180°)$. This means that the field propagation velocity V_5 becomes smaller again with respect to the spatial density. The particle structures will dissolve as the period increases. This is comparable to a sandcastle that disperses in water. In today's favoured standard model of the universe, this would be incorrectly interpreted as a further expansion of space until the particles dissolve. According to the present model, the reason for the dissipation of particle and energy structures lies in two factors. First, the course of the expansion of the universe influences the global gravitational potential between objects up to the location $dM(\alpha = 90°)$, where the field potential has become minimally small. Second, as the period continues, the direction of attractive forces changes to repulsive forces.