3.5 Particle-exchange Fion-Particle-Coupling

The previous chapter described how particles are arranged in field-space. The spatial structure described is a prerequisite for integrating the four fundamental forces into this model. The electromagnetic, strong, and weak interactions, as well as the gravitational force, are derived from the value of the coupling frequency.

All more complex particles are derived from an extension of the electron with the simplest electron configuration EC = 3 (**Chapter 2.2, Point 17**). As an elementary particle, the electron thus constitutes the simplest charged particle structure in space-time. An exchange fion is the carrier of the interaction. The exchange of fields during coupling is registered as an interaction. For recombination into a complex particle, the exchange fion must reduce its wavelength until a resonance state prevails. To do this, it tunes itself to a multiple of the electron's coupling frequency. This factor is derived in this chapter and leads to the general formula for particles. Using the same factor for the electron frequency also provides the factor for the mass of any particle.

The electron frequency f_e:

To determine the electron frequency f_e, its mass M_e must be determined. The mass of the electron M_e is known from the relevant technical literature. This measured value is used as a base constant in the FSM.

Electron frequency [f_e] in Hz ; electron mass [M_e] in kg

The wavelength λ_e of the electron with mass M_e is:

$$\lambda_e = \frac{h}{M_e\, c} \tag{3.09}$$

with: h = 6,626 10^{-34} Js; M_e = 9,1094 10^{-31} kg; c = 299792458 $\frac{\text{m}}{\text{s}}$

$$\lambda_e = \frac{6{,}626\ 10^{-34}\ \text{Js}}{9{,}1094\ 10^{-31}\text{kg} \cdot 299792458\ \frac{\text{m}}{\text{s}}} = 2{,}4263\ 10^{-12}\ \text{m}$$

$$f_e = \frac{c}{\lambda_e} \tag{3.10}$$

$$\underline{\underline{f_e}} = \frac{299792458\ \frac{\text{m}}{\text{s}}}{2{,}4263\ 10^{-12}\ \text{m}} = \underline{\underline{123{,}56\ \text{Exa Hz} = 1{,}2356\ 10^{20}\ \text{Hz}}}$$

The coupling configuration – CC:

For a field exchange between exchange fions and electrons, it is necessary that the respective frequencies resonate. For resonance with the electron, the exchange fion must couple with three active fions simultaneously. Each individual active fion rotates with $V_{rot} = \frac{c}{2}$. The coupling factor for each active fion is therefore $\frac{1}{2}$. The **coupling configuration – CC** for an electron is CC $= \frac{3}{2}$ for three active fions. The exchange fion thus sets itself to a $\lambda_{Fion} = \frac{2}{3}\lambda_e$ smaller wavelength than for the three active fions in the electron.

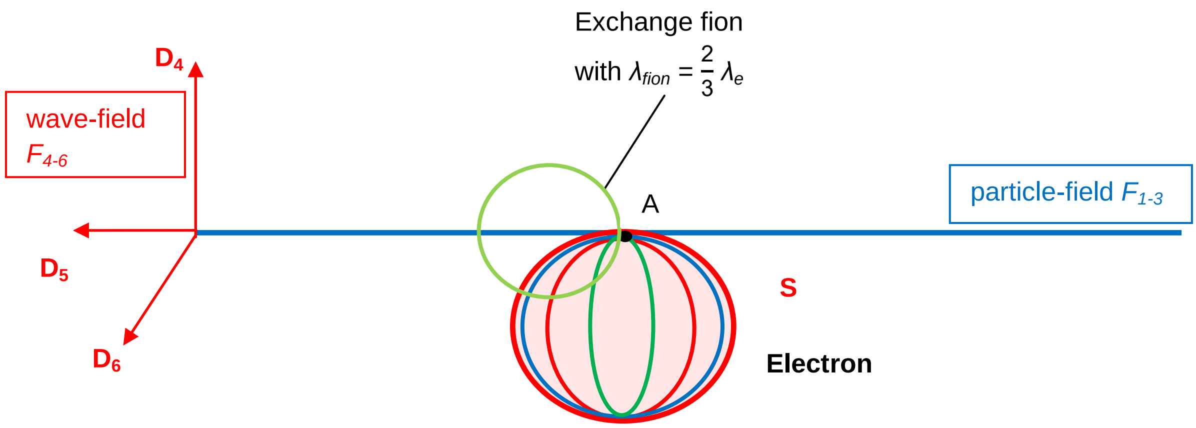


Figure 3.22: The electron in the dimension plane D_{45} is represented by a wavelength λ_e with a factor of 1; the exchange fion adjusts itself to a multiple of this wavelength

The above case refers to the ideal resonance state between the electron with its three active fions and the exchange fion. The multiples of fion frequencies relative to the stable electron are particularly interesting, because this multiplied field force is periodically transmitted to the particle-field F_{1-3} via field exchange with its 2-dimensional field vector from the wave-field F_{4-6}.

$$\text{CC(EC)} = \frac{\text{No. of active fions}}{\text{period duration } T \text{ of fions with reference to } c} \tag{3.11}$$

$$\text{CC(EC=3)} = \frac{\text{3 active fions}}{\text{period duration } 2T} = \frac{3}{2}$$ (applies to the elementary particles electrons and u/d-quarks)

Further modes for the expansion of active fions in the electron sphere:

$$\text{CC(EC=4)} = \frac{\text{4 active fions}}{\text{period duration } 2T} = \frac{4}{2}$$ (C-quarks)

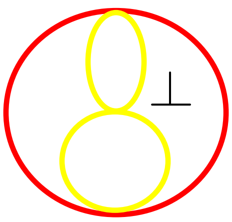
$$\text{CC(EC=5)} = \frac{\text{5 active fions}}{\text{period duration } 2T} = \frac{5}{2}$$ (B-quarks)

<u>Comment for T-quarks:</u> The electron configuration of EC = 6 indicates that these quarks need seven dimensions. In the author's opinion, bosons with six or more active fions should not exist in a 6-dimensional space, taking into account the maximum speed $V_{max} = c$. Unless there is a short-lived seventh to ninth dimension that could arise through a specific excitation to a further field-space level. The expansion of the spatial dimensions can be modelled using Field-Space-Mechanical Relativity Theory. For the purposes of this paper, let us assume that T-quarks exist briefly as 7-dimensional particles.

$$\text{CC(EC=6)} = \frac{\text{6 active fions}}{\text{period duration } 2T} = \frac{6}{2} \qquad \text{(T-quarks)}$$

<u>Comment for S-quarks:</u> The S-quark is similar to a u/d-quark, but with the difference that these fions have exactly half the wavelength of a fion in the u/d-quark with $\frac{1}{2}\,\lambda_{u/d}$ and additionally rotate orthogonally to each other.

Theoretically, this would allow for two sets of three fions rotating at half the wavelength of the u/d-quark. The limitation on the coupling factor is four instead of six active fions, because otherwise six 4-dimensional rotational paths would have to be considered, which would already require a seventh dimension. This is not possible without special excitation. It can be observed that particles with S-quarks also exist without a field-shifting excitation. For its undisturbed resonance frequency, the maximum number of fions with half the wavelength of the u/d-quark is sought, since these represent the smaller wavelength at which an exchange fion must couple. Thus, only four active fions with half wavelength are considered for the numerator for the lowest resonance frequency. For the denominator, an additional reduction in the rotation speed to $V_{rot} = \frac{c}{3}$ applies to these modes because the wavelengths of the active fions have decreased relative to a possible exchange fion. The coupling configuration CC can now be formed with this smallest resonance frequency.



$$\text{CC(EC=5)} = \frac{4}{3} \quad \text{Note: Orbital velocity: } V_{rot} = \frac{c}{3}$$

$$\text{CC(EC=3)} = \frac{3}{2} \quad \text{Note: Orbital velocity: } V_{rot} = \frac{c}{2}$$

$$\text{CC(EC=5)} = \frac{\text{4 times 0,5 } \lambda \text{ active fions of u/d-quark}}{3T \text{ by orbital velocity } 1/3\ c} = \frac{4}{3} \qquad \text{(S-quarks)} \qquad (3.12)$$

Coupling configuration CC* in the event of a disturbance:

In the event of an external disturbance, the 1:1 coupling of the three active fions, which exchange their fields on the dimension planes $D_{14/24/34}$ with the particle-field $F_{1\text{-}3}$, is disrupted. One example is an object velocity V_3 that affects the field propagation velocity $V_5 = c$. This would result in a deviation in space-time. This disturbance could therefore have a direct influence on the active fions in the field-space on the dimension planes $D_{14/24/34}$. Within the electron, space-time mechanical effects parallel to the fourth spatial dimension D_4 lead to elliptical rotational orbits, which increase the field propagation speed V_4. Such fion frequencies deviate slightly from undisturbed particles.

Assuming that the external disturbances are minor ($\Delta f \ll f$), the previously undisturbed coupling configuration must form a further multiple of the original electron frequency in order to find a synchronisation for the exchange fion with the disturbed electron.

This also applies to more complex particles in the field-space because they can only be disturbed on the three dimensional planes $D_{14/24/34}$ of the particle-field $F_{1\text{-}3}$. Therefore, the undisturbed coupling configuration CC must be raised to the power of 3 for three perturbable fions. The exchange fion achieves a much smaller wavelength λ_{fion} for the coupling with a disturbed elementary particle with its disturbed coupling configuration CC*.

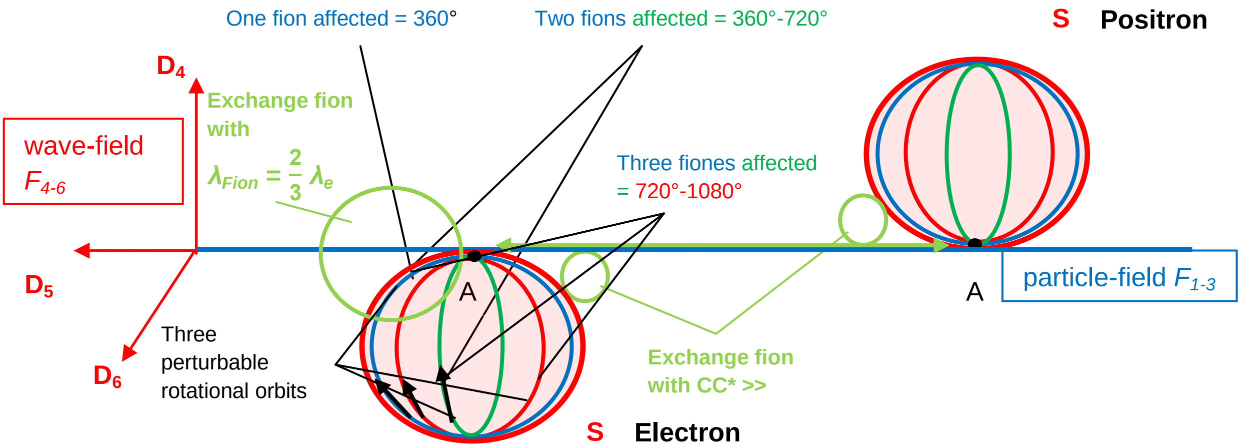


Figure 3.23: Exchange fions with much smaller wavelengths in the event of disturbances

These results in the following disturbed coupling configuration – CC* – for the elementary particles:

$$CC^* = (CC)^3 \quad (3.13)$$

This ratio of potentiation also applies to quarks with the following coupling configurations – CC:

- An electron with the coupling configuration CC (EC=3) = $\frac{3}{2}$ provides with perturbation CC*(EC=3) = $(\frac{3}{2})^3$, e.g. for u/d-quarks
- An electron with the coupling configuration CC (EC=4) = $\frac{4}{2}$ provides with perturbation CC*(EC=4) = $(\frac{4}{2})^3$, e.g. for C-quarks
- An electron with the coupling configuration CC (EC=5) = $\frac{5}{2}$ provides with perturbation CC*(EC=5) = $(\frac{5}{2})^3$, e.g. for B-quarks
- An electron with the coupling configuration CC (EC=6) = $\frac{6}{2}$ provides with perturbation CC*(EC=6) = $(\frac{6}{2})^3$, e.g. for T-quarks.
- An electron with the coupling configuration CC (EC=5) = $\frac{4}{3}$ provides with perturbation CC*(EC=5) = $(\frac{4}{3})^{3,4,5,6,7,8}$, e.g. for S-quarks

For the S-quark, up to eight powers are conceivable as perturbations. The reason is that in the special case with 2 × 2 active fions with the wavelength $\frac{1}{2}\,\lambda_{u/d}$ these rotate relative to each other by 2 × 2 for the respective orthogonal orientation within the sphere of the electron. The boson configuration for the S-quark could take on 6-dimensions in the special case of BC = $\frac{2..12 \text{ and } 14}{2 \cdot 3}$. As it turns out, the fifth power occurs most frequently.

Consideration of the boson configuration BC:

The boson configuration BC is taken into account for the disturbed coupling configuration CC* because, for various cases of fion exchange by means of prior reception of external fions, the mass number in the numerator increases, which may contribute to the multiple of the fion frequency. The product of the boson configuration BC and the perturbed coupling configuration CC* results in the excitation of a harmonic of the exchange fion with respect to its total oscillation. This harmonic is represented as frequency f^*.

$$f^* = \text{BC CC}^*\, f_e \qquad \text{with } [f^*] = \text{Hz} \qquad (3.14)$$

Excitation frequency of a harmonic f^* for the electron in the event of a disturbance:

$f^*_{electron} = \frac{3}{3} (\frac{3}{2})^3 f_e = 3,375 f_e$

In the event of a disturbance of the u/d-quark, the following frequency applies to its harmonic f^*:

$f^*_{u/d\text{-}quark} = f^*_{electron}$ (eF1) $= \frac{4}{3} (\frac{3}{2})^3 f_e = 4,5 f_e$

Further quark excitations:

$f^*_{C\text{-}quark} = \frac{4}{4} (\frac{4}{2})^3 = 8 f_e$

$f^*_{B\text{-}quark} = \frac{5}{5} (\frac{5}{2})^3 = 15,625 f_e$

$f^*_{T\text{-}quark} = \frac{6}{6} (\frac{6}{2})^3 = 27 f_e$

$f^*_{S\text{-}quark} = \frac{5}{5} (\frac{4}{3})^5 = 4,214 f_e$

$f^*_{S\text{-}quark}$(eF1) $= \frac{6}{5} (\frac{4}{3})^5 = 5,057 f_e$

When compensating for disturbances, a low disturbance frequency with $\Delta f << f$ has been assumed up to now. Depending on the severity of the disturbance, the frequency may increase further.

$f^*_{exchange\ fion} = 4.5 f_e$ → However, the numerical factors of the respective disturbance frequencies still assume coupling after period *1T*, which corresponds to a harmonic of the total oscillation. Further factors follow for the exchange of fions, which are capable of doing, so taking into account their rotation on further dimensional planes.

Number of periods *T* for individual disturbed fions in an electron:

The superposition of all harmonics results in the total vibration for the bosonic exchange within any particle. It depends on the total number of periods T it takes for the exchange function to synchronize with the particle. All rotation matrices required for an exchange are taken into account. The number of rotation matrices is determined by the state of complexity the particle assumes at rest. On average, a rest state is then established as soon as all partial movements add up to zero. For the electron, this is ensured with a double rotation matrix. After a period of $1T$ in the dimension plane D_{45}, all fions along their 4-dimensional rotational paths have crossed the point of contact once ($\overrightarrow{e_6}\, dD_4 dD_5 = \overrightarrow{dA} = D_{45}$). Since the sphere S rotates in space using its own rotation matrix ($\overrightarrow{e_5}\, dD_4 dD_6 = \overrightarrow{dA} = D_{46}$), it changes direction every $2T$ periods. On average, $V_{rot} = \frac{\sqrt{3}}{2} c - \frac{\sqrt{3}}{2} c = 0$. In a 6-dimensional view, the axis of rotation in the dimension plane D_{56} is added ($\overrightarrow{e_4}\, dD_5 dD_6 = \overrightarrow{dA} = D_{56}$). Taking into account all three rotation matrices for all three dimensional planes, the period is therefore $3T$ until a full rotation is complete.

Depending on how many fions are disturbed on which paths, this can have an effect on the orthogonal movement in the wave-field $F_{4\text{-}6}$. All dimension planes $D_{45/46/56}$ in the field $F_{4\text{-}6}$ where a disturbance could have occurred, even if only partially on average, are taken into account. The more fions are disturbed in the reference field $F_{4\text{-}6}$, the greater the factor for the period. If the exchange fion couples to two disturbed electrons, two different periods $2T$ must coincide with the period T of the exchange fion. Ultimately, the more periods it takes to achieve synchronization between the disturbed particle and an exchange fion, the higher the frequency of the exchange fion must be.

The following cases result in the exchange fion multiplying its harmonic frequency f^* in a bosonic total oscillation with the frequency f^{**}: $[f^{**}] = \text{Hz}$

a) Two quarks are in field exchange with each other, each with three disturbed active fions, which rotate with two independent rotation matrices along the dimension planes $D_{45/46}$ in the 5-dimensional space and each with a period duration of $2T$. This corresponds to $2 \times 2T$ to the fourth power.

$$f^{**}_{u/d\text{-}quark}(4T) = (4{,}5)^4 f_e \tag{3.15}$$

b) One quark interacts with another quark, each with three disturbed active fions, in a field exchange that rotates with two independent rotation matrices on the dimension planes $D_{45/46}$ and a period duration of $2T$ in the 5-dimensional range. The neighbouring quark, on the other hand, rotates with three independent rotation matrices on the dimension planes $D_{45/46/56}$ with a period duration of $3T$ in the 6-dimensional range. This field exchange corresponds to the factor with the period duration of $2T + 3T$ to the fifth power.

$$f^{**}_{u/d\text{-}quark}(5T) = (4{,}5)^5 f_e \tag{3.16}$$

c) For a field exchange between two quarks, each with three disturbed active fions, these rotate with three independent rotation matrices on the dimension planes $D_{45/46/56}$ and a period duration of $3T$ using the 6-dimensional range. This corresponds to the factor with the period duration $2 \times 3T$ to the sixth power.

$$f^{**}_{u/d\text{-}quark}(6T) = (4{,}5)^6 f_e \tag{3.17}$$

The lowest energetic excitation state begins using of the 5-dimensional range with the fourth power. This lowest excitation state is probably the most common among all particle types in nature.

Dimension family *n* (with *n* ε N):

$$f^{**}(nT) = (\mathrm{BC\ CC^*})^n \ f_e \tag{3.18}$$

n stands for the power and at the same time for the characteristic number of *T* periods between particles that can be traced back to the dimensions used.

Dimension reduction factor $\sqrt{\frac{5}{6}}$ & $\frac{5}{6}$:

The dimension reduction factor has already been mentioned in various places in this paper. Without this dimension reduction factor, no correction could be made for possible spatial structural differences between quarks to obtain a uniform mass formula. This correction of the orbital velocity affects the entire particle, so that the factor reduces its mass.

If force transmitters and receivers are affected, e.g. with a particle-exchange-ion-particle-coupling in the 5-dimensional range, then the maximum propagation velocity V_{max} is distributed across all five dimensions as follows:

$$V_{max} = V_{D1} + V_{D2} + V_{D3} + V_{D4} + V_{D5} = \frac{1}{5}\,c + \frac{1}{5}\,c + \frac{1}{5}\,c + \frac{1}{5}\,c + \frac{1}{5}\,c = c \tag{3.19}$$

In a 5-dimensional space, the factor $\sqrt{\frac{c}{5}}$ applies to the force transmitter in each spatial direction, depending on the number of dimensions used. The following therefore applies to the force transmitter and force receiver:

$$V_{D1} = \sqrt{\frac{c}{5}}\,\sqrt{\frac{c}{5}} = \frac{1}{5}\,c$$

By using the 6-dimensional space, the following applies accordingly:

$$V_{max} = \frac{1}{6}\,c + \frac{1}{6}\,c + \frac{1}{6}\,c + \frac{1}{6}\,c + \frac{1}{6}\,c + \frac{1}{6}\,c = c$$

Considering that two 6-dimensional particles with a trigonometrically resulting velocity of $V_{rot} = \frac{\sqrt{5}}{2}\,c > c$ (B-quarks) exchange, the factor for the maximum velocity V_{max} must be reduced to $V_{max} = c - \frac{1}{6}\,c = \frac{5}{6}\,c$ so that its rotational velocity V_{rot} does not exceed the maximum velocity V_{max}. As the maximum speed V_{max} decreases, the particle mass and the coupling frequency of the affected particle also decrease. The dimension reduction factor is referred to as "Dimfactor" in the formulas.

$$f^{**}_{electron} = [\frac{3}{3}(\frac{3}{2})^3]^n f_e \quad (3.20)$$

$$f^{**}_{u/d\text{-}quark} = f^{*}_{Electron}(eF1) = [\frac{4}{3}(\frac{3}{2})^3]^n f_e \quad (3.21)$$

$$f^{**}_{C\text{-}quark} = [\frac{4}{4}(\frac{4}{2})^3]^n f_e \quad (3.22)$$

$$f^{**}_{B\text{-}quark} = [\frac{5}{5}(\frac{5}{2})^3]^n \sqrt{\frac{5}{6}} f_e \qquad \sqrt{\frac{5}{6}} \text{ due to boson in } R^6 \quad (3.23)$$

$$f^{**}_{T\text{-}quark} = [\frac{6}{6}(\frac{6}{2})^3]^n \sqrt{\frac{5}{7}} f_e \qquad \sqrt{\frac{5}{7}} \text{ due to boson in } R^7 \quad (3.24)$$

$$f^{**}_{S\text{-}quark} = [\frac{5}{5}(\frac{4}{3})^5]^n f_e \qquad \frac{4}{3} \text{ due to } \frac{1}{2}\lambda_{u/d} \text{ im } R^6 \quad (3.25)$$

$$f^{**}_{S\text{-}quark}(eF1) = [\frac{6}{5}(\frac{4}{3})^5]^n f_e \qquad \frac{4}{3} \text{ due to } \frac{1}{2}\lambda_{u/d} \text{ im } R^6 \quad (3.26)$$

S-quark: no further reduction of the maximum velocity V_{max} is necessary. This has already been taken into account in the denominator with the velocity $V_{rot} = \frac{c}{3}$.

Consideration of particle configuration PC:

The total bosonic vibration *f*** must form the product with the particle configuration in order to take into account all bosons involved in any particle structure. The frequency required for resonance between an exchange fion and the particle increases further by this factor. Various particle configurations PC are already known from **Chapter 3.3**:

- the fion: PC = $\frac{1}{3}$
- the electron: PC = $\frac{3}{3}$
- the meson-boson: PC = $\frac{4}{3}$ ($\rightarrow \frac{4}{3} = \frac{3-1}{3} + \frac{3-1}{3}$)
- the meson: PC = $\frac{6}{3}$ ($\rightarrow \frac{6}{3} = \frac{4-1}{3} + \frac{4-1}{3}$)
- the baryon: PC = $\frac{6}{3}$ ($\rightarrow \frac{6}{3} = \frac{4-2}{3} + \frac{4-2}{3} + \frac{4-2}{3}$).

These are the usual types of particles that occur in nature.

Coupling factor $\frac{1}{2}$ during the transition of an unbound fion to a bound fion:

The transition of all unbound fions in a complex particle rotating at a speed $V_{max} = c$ to bound active fions rotating at $V_{rot} = \frac{c}{2}$ halve's their rotational speed in order to adapt. This occurs during the transition from particle 1 as an exchange fion to particle 2. This coupling factor must be taken into account in the calculation, as it reduces the particle frequency and mass.

Definition of the coupling frequency:

Taking into account the coupling configuration, interference factors, the boson configuration, the dimension family, the particle configuration, the coupling between a free exchange fion and a bound exchange fion, and the dimension reduction factor, this complex factorised frequency of objects is referred to as **the coupling frequency**. Therefore, the object frequency f_{obj} automatically corresponds to the coupling frequency, the nomenclature for this model can be used in the same way.

Mass and coupling frequency of particles:

The mass and particle frequency can be calculated in generalised form as follows:

$$f_{obj} = \frac{1}{2} (BC\ (CC)^3\ )^n \cdot PC \cdot Dimfactor \cdot f_e \qquad (3.27)$$

$$M_{obj} = \frac{1}{2} (BC\ (CC)^3)^n \cdot PC \cdot Dimfactor \cdot M_e \qquad (3.28)$$

within:

- f_{obj} – coupling frequency for arbitrary objects
- M_{obj} – mass for arbitrary objects
- $\frac{1}{2}$ for half the speed of an unbound exchange fion to a bound active fion in a particle-exchange fion-particle-coupling
- BC – boson configuration: $\frac{\text{No. of active fions + No. extern fions}}{\text{No. active fions}}$
- CC – coupling configuration: $\frac{\text{No. of active fions}}{\text{period duration } T \text{ of fions with reference to } c}$
- Power of three for the three possible fions that can be disturbed from the particle-field
- n – nth dimension family
- PC – particle configuration: $\frac{\text{No. of active fions + No. extern fions – No. exchange fion/passive fion-pair}}{\text{No. active fions}}$
- Dimfactor for reducing the maximum velocity V_{max}
- M_e is the mass of the electron
- f_e is the frequency of the electron

Formulas (3.27) and (3.28) consist of a mathematically consistent equation that represents the particles as the product of several harmonics. A wave equation and complex mathematical operators are not necessary. This greatly simplifies the basic handling from a mathematical point of view.

The individual harmonics provide different information about the structure of a particle. When combined, these harmonics overlap to form a total vibration. In this case, the superimposed information is transferred to an **information matrix**, which describes complex objects.

3.6 Calculation of particle masses and coupling frequencies

The formula for calculating the mass and coupling frequency for the respective interaction in the field-space is available. These formulas will now be verified in this chapter by comparing the particle masses determined on the basis of the standard model of particle physics with the theoretically determined masses of the FSM.

Deviations between calculated and measured values:

The masses predicted by Field-Space-Mechanics are mathematical averages across all disturbance frequencies, couplings and possible periods. In reality, there will be slight fluctuations around the mean values given below. There could be many reasons for this. The exact disturbances, which may be due to the influence of hidden matter or relativistic effects, could lead to deviations. Each of these mean values requires a standardised standard deviation that expresses the variance with a high degree of probability.

Conversion of experimental values:

Experimentally proven measured values are given as multiples of the electron mass. The auxiliary conversion of a measured factor X with the energy in MeV can be carried out using a simple rule of three to a factor Y from the multiple of the electron mass M_e in kg. The proton mass is used for the required ratio, which already corresponds to a valid measured value with a deviation from the calculated prediction of $< 1\%$. Any deviations are included as consequential errors relative to the theoretically determined value. The calculated deviations will be approximately ±1% of the measured value.

$M_{proton} = 1836\ M_e \qquad [M_e] = \mathrm{kg}$

$E_{proton} = 938{,}38\ \mathrm{MeV}$

$$Y\ M_e = \frac{1836\ M_e}{938{,}38\ \mathrm{MeV}} \cdot X\ \mathrm{MeV} \qquad (3.29)$$

Some of the calculated masses were measured experimentally. These are designated as "experimental" and are listed in the references.

0. Dimension family: (power 0)

These include the electron, the positron and the neutrino in its most stable form:

$M_{electron} = 1\ M_e$

The values of the formula symbols are substituted into formula (3.28):

$$M_{electron} = [\frac{3}{3} (\frac{3}{2})^3]^0 \frac{3}{3} M_e = 1\ M_e$$

$$M_{u/d\text{-}quark} = M_{electron}(\text{eF1}) = [\frac{4}{3} (\frac{3}{2})^3]^0 \frac{3}{3} M_e = 1\ M_e$$

$$M_{C\text{-}quark} = [\frac{4}{4} (\frac{4}{2})^3]^0 \frac{3}{3} M_e = 1\ M_e$$

$$M_{B\text{-}quark} = [\frac{5}{5} (\frac{5}{2})^3]^0 \frac{3}{3} M_e = 1\ M_e$$

$$M_{T\text{-}quark} = [\frac{6}{6} (\frac{6}{2})^3]^0 \frac{3}{3} M_e = 1\ M_e$$

$$M_{S\text{-}quark}(\text{eF1}) = [\frac{6}{5} (\frac{4}{3})^5]^0 \frac{3}{3} M_e = 1\ M_e$$

For the 0th dimensional family, all elementary particles are reduced to the mass of the electron.

1st dimension family: (power 1 – interaction only in the 4-dimensional range)

The 1st dimension family represents the exchange interaction of the mass of a harmonic from its quark excitation. This includes the quark excitations of the individual quarks: the u/d-quark, S-quark, C-quark, B-quark, T-quark:

$$M_{u/d\text{-}quark} = [\frac{3}{3} (\frac{3}{2})^3]^1 \frac{3}{3} M_e = 3{,}375\ M_e$$

$$M_{u/d\text{-}quark} = M_{electron}(\text{eF1}) = [\frac{4}{3} (\frac{3}{2})^3]^1 \frac{3}{3} M_e = 4{,}5\ M_e$$

$$M_{C\text{-}quark} = [\frac{4}{4} (\frac{4}{2})^3]^1 \frac{3}{3} M_e = 8\ M_e$$

$$M_{B\text{-}quark} = [\frac{5}{5} (\frac{5}{2})^3]^1 \frac{3}{3} \sqrt{\frac{5}{6}} M_e = 14{,}26\ M_e \qquad (R^6 \text{ possible})$$

$M_{T\text{-}quark} = [\frac{6}{6}(\frac{6}{2})^3]^1 \frac{3}{3}\sqrt{\frac{5}{7}}\, M_e = 22{,}82\ M_e$ (from 7th dimension)

$M_{S\text{-}quark} = [\frac{6}{5}(\frac{4}{3})^5]^1 \frac{3}{3}\, M_e = 5{,}06\ M_e$ (R^6 possible)

Table 3.3 below summarises the quark excitations derived so far for the first dimensional family. Since mesons, with their integer spin, are also hypothetically suitable for representing a bosonic exchange, it may be possible to find further particle structures. The cases derived so far for the particle configurations of the mesons from **Chapter 3.3** are listed in the "BC" column.

For the C-quark: it would be conceivable that it mainly interferes with the harmonics of u/d-quarks in the structure of a baryon. In this case, the bosonic exchange would be characterised by the boson configuration BC(eF1) = $\frac{4}{3}$. This boson configuration is listed here for the sake of completeness.

(3.30)

Quark	**Quark excitation**	**BC** (boson, meson-boson, meson)	**Note** Mesons consist of two bosons, each of which lacks an active fion.
u/d-quark (occupying the lowest energy level)	$[BC\,(\frac{3}{2})^3]^1$	• $\frac{4}{3}$	$\frac{4}{3} = \frac{2}{3} + \frac{2}{3}$
C-quark	$[BC\,(\frac{4}{2})^3]^1$	• $\frac{4}{3}$; $\frac{4}{4}$; $\frac{6}{4}$	$\frac{4}{3} = \frac{2}{3} + \frac{2}{3}$ $\frac{6}{4} = \frac{3}{4} + \frac{3}{4}$
B-quark	$[BC\,(\frac{5}{2})^3]^1 \sqrt{\frac{5}{6}}$	• $\frac{5}{5}$; $\frac{8}{5}$	$\frac{8}{5} = \frac{4}{5} + \frac{4}{5}$
T-quark	$[BC\,(\frac{6}{2})^3]^1 \sqrt{\frac{5}{7}}$	• $\frac{6}{6}$; $\frac{10}{6}$	$\frac{10}{6} = \frac{5}{6} + \frac{5}{6}$
S-quark	$[BC\,(\frac{4}{3})^{3,4,5,6,7,8}]^1$	• $\frac{5}{5}$; $\frac{6}{5}$; $\frac{8}{5}$; $\frac{8{,}5}{5}$; $\frac{9}{5}$; $\frac{9{,}5}{5}$; $\frac{10}{5}$	$\frac{8}{5} = \frac{4}{5} + \frac{4}{5}$

Table 3.3: Possible boson configurations for the quark excitation of the u/d-, C-, B-, T- and S-quarks

Hypothetically, the variety can be increased as follows: For dimension families 0 to 3, the boson configuration can only be represented as BC = $\frac{3\ldots5}{3\ldots5}$. For dimension families 4 to 6, the boson configurations can be extended with the electron BC = $\frac{3\ldots5}{3\ldots5}$, the meson BC = $\frac{4\ldots14}{3\ldots5}$ and the baryon BC = $\frac{6\ldots12}{3\ldots5}$ (usually with $\frac{6}{3}$).

The S-quark can assume different modes. Conceivable would be the boson configuration for the meson boson in the 5-dimensional case with BC = $\frac{2..11}{5}$ or in the 6-dimensional case with BC = $\frac{2..12 \text{ und } 14}{2 \cdot 3}$, if it has absorbed an external fion in each case.

The first dimensional family is particularly important because these individual quark excitations, which represent a harmonic, stand for the individual subspaces of complex particles in their spatial structure. Depending on the particle, only the product of several of these harmonics is needed to find its coupling frequency. The object mass is derived from the same factor.

4th dimensional family: (power 4 – interaction in the 5-dimensional realm)

The 4th dimension family represents the lowest energy excitation state of an electron with which it can interact with a partner. The reason for this is that two disturbed quarks, each with three disturbed active fions, rotate in the 5-dimensional space with a period of 2*T*. This results in the fourth power for the exchange fion. During the field exchange between the unbound and bound states, the exchange fion returns to the velocity of $V_{rot} = \frac{c}{2}$. From this dimensional family onwards, the factor $\frac{1}{2}$ therefore applies.

The following particle types are modelled. The free fion with particle configuration PC = $\frac{1}{3}$ without coupling $\frac{1}{2}$, the muon as an electron with PC = $\frac{3}{3}$, the pion as a meson-boson with PC = $\frac{4}{3}$ and the meson with PC = $\frac{6}{3}$ consisting of two muons are calculated for the 4th dimension family as follows:

$M_{fon} = [\frac{4}{3}(\frac{3}{2})^3]^4 \frac{1}{3} M_e = 136{,}6875\, M_e$ → **the lowest mass of an exchange fion**

$M_{muon/electron,4.} = \frac{1}{2}[\frac{4}{3}(\frac{3}{2})^3]^4 \frac{3}{3} M_e = 205{,}031\, M_e$ (206,73 M_e experimental)

With a factor of~ 205, the muon is only slightly above the lowest mass of ~137. This suggests that the muon tends towards instability.

For the pion, the particle configuration of a meson-boson with PC = $\frac{4}{3} = \frac{4-2}{3} + \frac{4-2}{3}$ applies**.**

$M_{pion/meson\text{-}boson,\,4.} = \frac{1}{2}[\frac{4}{3}(\frac{3}{2})^3]^4 \frac{4}{3} M_e = 273{,}375\, M_e$ (273,1 M_e experimental)

The hypothetical meson with its particle configuration PC = $\frac{6}{3}$:

$$M_{meson,from\ 2\ muons,4.} = \frac{1}{2}\left[\frac{4}{3}\left(\frac{3}{2}\right)^3\right]^4 \frac{6}{3} M_e = 410{,}0625\ M_e$$

The meson from the 4th dimension family has not yet been discovered. As a heavy meson, it would probably be too unstable. Furthermore, the 4th dimension family with its linear exchange possibility in the 5-dimensional range is not sufficient to represent this particle configuration as a baryon.

The composition of the formula symbols for the muon is examined in more detail below in order to understand its components.

$$M_{muon/electron,4.} = \frac{1}{2}\left[\frac{4}{3}\left(\frac{3}{2}\right)^3\right]^4 \frac{3}{3} M_e = 205{,}031\ M_e$$

$\frac{\mathbf{3}}{\mathbf{2}} = \frac{\text{No. active fions}}{\text{period duration}}$ – Coupling configuration CC for a resonance between an exchange fion and the three undisturbed active fions. The exchange fion must couple to each active fion with a coupling factor of $\frac{1}{2}$.

( )³ – The power with the factor 3 takes into account the three possible active fions that can be disturbed from the particle-field $F_{1\text{-}3}$.

$\frac{\mathbf{4}}{\mathbf{3}} = \frac{\text{No. of active fions + No. extern fions}}{\text{No. active fions}}$ – Boson configuration BC. For the bosonic exchange, the electron has temporarily absorbed an external fion. During the fion exchange, the electron exists as a u/d-quark.

[ ] ⁴ – *n*-th dimension family. Factor 4 stands for the exchange of two disturbed particles that encounter each other with two rotation matrices in the dimension planes $D_{45/46}$. A 4-fold potentiated quark excitation is required for a resonance of an exchange fion with such a particle structure.

$\frac{\mathbf{1}}{\mathbf{2}}$ – Factor stands for half the maximum velocity $V_{max} = c$ when an unbound exchange fion is absorbed into a bound disturbed particle.

$\frac{\mathbf{3}}{\mathbf{3}} = \frac{\text{No. of active fions + No. extern fions – No. exchange fion/passive fion-pair}}{\text{No. active fions}}$ – Particle configuration PC. In this case, the exchange fion exchanges with the muon particle, which is modelled as a particle configuration like an electron with three active fions.

Dim factor – **1**, due to the use of 5-dimensional space, there is no reduction in the maximum velocity V_{max}.

$\boldsymbol{M_e}$ – Mass of the electron.

5th Dimension family: (power of 5 – interaction in the 5- to 6-dimensional range)

The electron with particle configuration PC = $\frac{3}{3}$, the meson-boson with PC = $\frac{4}{3}$, the meson with PC = $\frac{6}{3} = \frac{4-1}{3} + \frac{4-1}{3}$, and the baryon with PC = $\frac{6}{3} = \frac{4-2}{3} + \frac{4-2}{3} + \frac{4-2}{3}$ are modelled from the 5th dimensional family:

$$M_{electron,5.} = \frac{1}{2} \left[\frac{4}{3} \left(\frac{3}{2} \right)^3 \right]^5 \frac{3}{3} M_e = 922{,}640625\ M_e$$

The electron for the 5th dimensional family has not yet been discovered as a single particle.

$$M_{meson\text{-}boson,5.} = \frac{1}{2} \left[\frac{4}{3} \left(\frac{3}{2} \right)^3 \right]^5 \frac{4}{3} M_e = 1230{,}1875\ M_e$$

$$M_{baryon,5.} = \frac{1}{2} \left[\frac{4}{3} \left(\frac{3}{2} \right)^3 \right]^5 \frac{6}{3} M_e = 1845{,}28125\ M_e$$ → **Proton / Neutron**

(1836,15 M_e experimental)

Composition of the formula for the proton:

The essential difference between the proton and the muon lies in the exchange of its u/d-quarks with possible spin matrices on the additional dimension plane D_{56} and the particle type of the baryon. The proton consists of three u/d-quarks that exchange between each other via a binding neutrino.

Most of the relevant known complex particle structures will be composed of the fifth and, in part, the sixth dimension according to this particle model of the FSM.

Possible quark excitations from the 1st dimension family can be extended with the 0th dimension family. The effect would be mathematically 1 + 0 = 1. However, in this way, further intermediate frequencies for quarks can be found for particle masses of baryons and mesons, which have already been found by the international *Particle Data Group* (PDG). This results in a particle diversity that goes far beyond what is currently known. For the sake of clarity, this paper does not attempt to present all conceivable combinations. **Table 3.4** shows an example of this relationship for the u/d-quark. Numerous intermediate frequencies also apply to the other quarks, which are not all listed in this paper.

Quark excitation	Multiple f_e	Particle type
$[\frac{4}{3}(\frac{3}{2})^3]^1$	4,5	u/d-quark $_{boson,1}$
$[\frac{4}{3}(\frac{3}{2})^3]^1 + \frac{2}{3 \cdot 2}$	4,833	u/d-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{4}{3}(\frac{3}{2})^3]^1 + \frac{3}{3 \cdot 2}$	5	u/d-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{4}{3}(\frac{3}{2})^3]^1 + \frac{4}{3 \cdot 2}$	5,167	u/d-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{4}{3}(\frac{3}{2})^3]^1 + \frac{5}{3 \cdot 2}$	5,33	u/d-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{4}{3}(\frac{3}{2})^3]^1 + \frac{6}{3 \cdot 2}$	5,5	u/d-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{4}{3}(\frac{3}{2})^3]^1 + \frac{7}{3 \cdot 2}$	5,67	u/d-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{4}{3}(\frac{3}{2})^3]^1 + \frac{8}{3 \cdot 2}$	5,83	u/d-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{4}{3}(\frac{3}{2})^3]^1 + \frac{9}{3 \cdot 2}$	6	u/d-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{4}{3}(\frac{3}{2})^3]^1 + \frac{10}{3 \cdot 2}$	6,167	u/d-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{4}{3}(\frac{3}{2})^3]^1 + \frac{12}{3 \cdot 2}$	6,5	u/d-quark $_{boson,1.}$ + particle from 0. dimension family

Table 3.4: Variations for u/d-quark excitations

With the above quark excitations, several dozen variations of u/d-quark-based baryons can be calculated.

The S-quark has only been considered for a special case so far. **Table 3.5** below shows all bosonic variants and perturbations for the S-quark.

Quark excitation	Multiple f_e	Particle type
$[\frac{5}{5}(\frac{4}{3})^3]^1$	2,37	S-quark $_{boson,1.}$
$[\frac{6}{5}(\frac{4}{3})^3]^1$	2,84	S-quark $_{boson,1}$
$[\frac{8}{5}(\frac{4}{3})^3]^1$	3,79	S-quark $_{meson\text{-}boson,1.}$
$[\frac{8{,}5}{5}(\frac{4}{3})^3]^1$	4,0296	S-quark $_{meson}$
$[\frac{9}{5}(\frac{4}{3})^3]^1$	4,267	S-quark $_{meson}$
$[\frac{9{,}5}{5}(\frac{4}{3})^3]^1$	4,504	S-quark $_{meson}$
$[\frac{10}{5}(\frac{4}{3})^3]^1$	4,74	S-quark $_{meson}$
$[\frac{5}{5}(\frac{4}{3})^4]^1$	3,16	S-quark $_{boson,1.}$
$[\frac{6}{5}(\frac{4}{3})^4]^1$	3,79	S-quark $_{boson,1.}$
$[\frac{8}{5}(\frac{4}{3})^4]^1$	5,0568	S-quark $_{meson\text{-}boson,1.}$
$[\frac{8{,}5}{5}(\frac{4}{3})^4]^1$	5,3728	S-quark $_{meson}$
$[\frac{9}{5}(\frac{4}{3})^4]^1$	5,689	S-quark $_{meson}$
$[\frac{9{,}5}{5}(\frac{4}{3})^4]^1$	6,005	S-quark $_{meson}$
$[\frac{10}{5}(\frac{4}{3})^4]^1$	6,321	S-quark $_{meson}$
$[\frac{5}{5}(\frac{4}{3})^5]^1$	4,21	S-quark $_{boson,1.}$
$[\frac{6}{5}(\frac{4}{3})^5]^1$	5,057	S-quark $_{boson,1.}$
$[\frac{8}{5}(\frac{4}{3})^5]^1$	6,74	S-quark $_{meson\text{-}boson,1.}$
$[\frac{8{,}5}{5}(\frac{4}{3})^5]^1$	7,16	S-quark $_{meson}$
$[\frac{9}{5}(\frac{4}{3})^5]^1$	7,585	S-quark $_{meson}$

Quark excitation	**Multiple f_e**	**Particle type**
$[\frac{9,5}{5}(\frac{4}{3})^5]^1$	8,0066	S-quark $_{meson}$
$[\frac{10}{5}(\frac{4}{3})^5]^1$	8,428	S-quark $_{meson}$
$[\frac{5}{5}(\frac{4}{3})^6]^1$	5,6186	S-quark $_{boson,1.}$
$[\frac{6}{5}(\frac{4}{3})^6]^1$	6,742	S-quark $_{boson,1.}$
$[\frac{8}{5}(\frac{4}{3})^6]^1$	8,99	S-quark $_{meson-boson,1.}$
$[\frac{8,5}{5}(\frac{4}{3})^6]^1$	9,55	S-quark $_{meson}$
$[\frac{9}{5}(\frac{4}{3})^6]^1$	10,11	S-quark $_{meson}$
$[\frac{9,5}{5}(\frac{4}{3})^6]^1$	10,675	S- quark $_{meson}$
$[\frac{10}{5}(\frac{4}{3})^6]^1$	11,237	S-quark $_{meson}$
$[\frac{5}{5}(\frac{4}{3})^7]^1$	7,49	S-quark $_{boson,1.}$
$[\frac{6}{5}(\frac{4}{3})^7]^1$	8,99	S-quark $_{boson,1.}$
$[\frac{8}{5}(\frac{4}{3})^7]^1$	11,986	S-quark $_{meson-boson,1.}$
$[\frac{8,5}{5}(\frac{4}{3})^7]^1$	12,73	S-quark $_{meson}$
$[\frac{9}{5}(\frac{4}{3})^7]^1$	13,48	S-quark $_{meson}$
$[\frac{9,5}{5}(\frac{4}{3})^7]^1$	14,234	S-quark $_{meson}$
$[\frac{10}{5}(\frac{4}{3})^7]^1$	14,98	S-quark $_{meson}$
$[\frac{5}{5}(\frac{4}{3})^8]^1$	9,99	S-quark $_{boson,1.}$
$[\frac{6}{5}(\frac{4}{3})^8]^1$	11,99	S-quark $_{boson,1.}$

Quark excitation	Multiple f_e	Particle type
$[\frac{8}{5}(\frac{4}{3})^8]^1$	15,98	S-quark $_{meson\text{-}boson,1.}$
$[\frac{8{,}5}{5}(\frac{4}{3})^8]^1$	16,98	S-quark $_{meson}$
$[\frac{9}{5}(\frac{4}{3})^8]^1$	17,98	S-quark $_{meson}$
$[\frac{9{,}5}{5}(\frac{4}{3})^8]^1$	18,98	S-quark $_{meson}$
$[\frac{10}{5}(\frac{4}{3})^8]^1$	19,98	S-quark $_{meson}$

Table 3.5: Variations for S-quark excitations

For a selected S-quark, the 0th dimensionality family should be added below. These variances would hypothetically also be possible for all other powers $(\frac{4}{3})^{3,4,6,7,8}$.

Quark excitation	Multiple f_e	Particle type
$[\frac{6}{5}(\frac{4}{3})^5]^1$	5,0568	S-quark $_{boson,1.}$
$[\frac{6}{5}(\frac{4}{3})^5]^1 + \frac{2}{3\cdot 2}$	5,39	S-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{6}{5}(\frac{4}{3})^5]^1 + \frac{3}{3\cdot 2}$	5,557	S-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{6}{5}(\frac{4}{3})^5]^1 + \frac{4}{3\cdot 2}$	5,7235	S-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{6}{5}(\frac{4}{3})^5]^1 + \frac{5}{3\cdot 2}$	5,89	S-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{6}{5}(\frac{4}{3})^5]^1 + \frac{6}{3\cdot 2}$	6,0568	S-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{6}{5}(\frac{4}{3})^5]^1 + \frac{7}{3\cdot 2}$	6,2235	S-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{6}{5}(\frac{4}{3})^5]^1 + \frac{8}{3\cdot 2}$	6,39	S-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{6}{5}(\frac{4}{3})^5]^1 + \frac{9}{3\cdot 2}$	6,5568	S-quark $_{boson,1.}$ + particle from 0. dimension family

Quark excitation	**Multiple f_e**	**Particle type**
$[\frac{6}{5}(\frac{4}{3})^5]^1 + \frac{10}{3 \cdot 2}$	6,7235	S-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{6}{5}(\frac{4}{3})^5]^1 + \frac{11}{3 \cdot 2}$	6,89	S-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{6}{5}(\frac{4}{3})^5]^1 + \frac{12}{3 \cdot 2}$	7,0568	S-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{6}{5}(\frac{4}{3})^5]^1 + \frac{14}{3 \cdot 2}$	7,39	S-quark $_{boson,1.}$ + particle from 0. dimension family

Table 3.6: Selected S-quarks for the 1st dimension family, added to the proportions of the 0th dimension family

Quark excitation	**Multiple f_e**	**Particle type**
$[\frac{4}{4}(\frac{4}{2})^3]^1$	8	C-quark $_{boson,1.}$
$[\frac{6}{4}(\frac{4}{2})^3]^1$	12	C-quark $_{meson\text{-}boson,1.}$
$[\frac{4}{4}(\frac{4}{2})^3]^1 + \frac{2}{3 \cdot 2}$	8,33	C-quark $_{boson,1.}$ + particle from 0. dimension family
…	….	….
$[\frac{4}{4}(\frac{4}{2})^3]^1 + \frac{9}{3 \cdot 2}$	9,5	C-quark $_{boson,1.}$ + particle from 0. dimension family
…	….	….
$[\frac{4}{4}(\frac{4}{2})^3]^1 + \frac{12}{3 \cdot 2}$	10	C-quark $_{boson,1.}$ + particle from 0. dimension family
$[\frac{4}{3}(\frac{4}{2})^3]^1$	10,66	C-quark $_{meson\text{-}boson,1.}$
$[\frac{4}{3}(\frac{4}{2})^3]^1 + \frac{2}{3 \cdot 2}$	11	C-quark $_{boson,1.}$ + particle from 0. dimension family
…	…	…
$[\frac{4}{3}(\frac{4}{2})^3]^1 + \frac{12}{3 \cdot 2}$	12,66	C-quark $_{boson,1.}$ + particle from 0. dimension family

Table 3.7: Insight into the variations for C-quark excitations

Quark excitation	Multiple f_e	Particle type
$[\frac{5}{5}(\frac{5}{2})^3]^1 \cdot \sqrt{\frac{5}{6}}$	$15{,}625 \cdot \sqrt{\frac{5}{6}} =$ 14,264	B-quark $_{boson,1.}$
$[\frac{8}{5}(\frac{5}{2})^3]^1 \cdot \sqrt{\frac{5}{6}}$	$25 \cdot \sqrt{\frac{5}{6}} = 22{,}822$	B-quark $_{meson\text{-}boson,1.}$
$[\frac{5}{5}(\frac{5}{2})^3]^1 \cdot \sqrt{\frac{5}{6}} + \frac{2}{3 \cdot 2}$	$15{,}625 \cdot \sqrt{\frac{5}{6}} + \frac{2}{3 \cdot 2}$ =14,6	B-quark $_{boson,1..}$ + particle from 0. dimension family
…	…	…
$[\frac{5}{5}(\frac{5}{2})^3]^1 \cdot \sqrt{\frac{5}{6}} + \frac{12}{3 \cdot 2}$	16,264	B-quark $_{boson,1.}$ + particle from 0. dimension family

Table 3.8: Insight into the variations for B-quark excitations

Quark excitation	Multiple f_e	Particle type
$[\frac{6}{6}(\frac{6}{2})^3]^1 \cdot \sqrt{\frac{5}{7}}$	$27 \cdot \sqrt{\frac{5}{7}} = 22{,}82$	T-quark $_{boson,1.}$
$[\frac{10}{6}(\frac{6}{2})^3]^1 \cdot \sqrt{\frac{5}{7}}$	$45 \cdot \sqrt{\frac{5}{7}} = 38{,}03$	T-quark $_{meson\text{-}boson,1.}$
$[\frac{6}{6}(\frac{6}{2})^3]^1 \cdot \sqrt{\frac{5}{7}} + \frac{2}{3 \cdot 2}$	$27 \cdot \sqrt{\frac{5}{7}} + \frac{2}{3 \cdot 2} =$ 23,153	T-quark $_{boson,1.}$ + particle from 0. dimension family
…	…	…
$[\frac{6}{6}(\frac{6}{2})^3]^1 \cdot \sqrt{\frac{5}{7}} + \frac{12}{3 \cdot 2}$	24,82	T-quark $_{boson,1.}$ + particle from 0. dimension family

Table 3.9: Insight into the variations for T-quark excitations

Table 3.10 summarises the quark excitations given above for particle masses for selected particles. For each subspace U, a quark excitation from the first dimensional family is available.

Particle	**U**	**U**	**U**	**U**	**U**	**PC**		**mass calculated** M_e	**experim. mass** M_e
Proton-baryon	4,5	4,5	4,5	4,5	4,5	$\frac{6}{3}$	$\frac{1}{2}$	1845	1836
CS-meson D±	4,5	4,5	4,5	5,0568	8	$\frac{6}{3}$	$\frac{1}{2}$	3686	3658
C-meson	4,5	4,5	4,5	4,5	12	$\frac{6}{3}$	$\frac{1}{2}$	4921	
CS-meson $D_s^{\pm}$	4,5	4,5	4,5	5,39	8	$\frac{6}{3}$	$\frac{1}{2}$	3929	3853
CS-meson D^{*}_{s0} (2317)±	4,5	4,5	4,5	6,2235	8	$\frac{6}{3}$	$\frac{1}{2}$	4537	4535
CS-meson D_{s1}(2460)	4,5	4,5	4,5	6,5568	8	$\frac{6}{3}$	$\frac{1}{2}$	4780	4812
CS-meson D_{s1}(2536)	4,5	4,5	4,5	6,7235	8	$\frac{6}{3}$	$\frac{1}{2}$	4901	4960
CS-meson D^{*}_{s2} (2573)	4,5	4,5	4,5	6,89	8	$\frac{6}{3}$	$\frac{1}{2}$	5023	5027
…	…	…	…	…	…	…	…	…	…
CC-meson J/ψ(1S)	4,5	4,5	4,5	8,33	8	$\frac{6}{3}$	$\frac{1}{2}$	6072	6060
CS-baryon Ξ^0_c	4,5	4,5	4,5	6,89	8	$\frac{6}{3}$	$\frac{1}{2}$	5023	5046
CS-baryon Ξc (2645)	4,5	4,5	4,5	7,0568	8	$\frac{6}{3}$	$\frac{1}{2}$	5144	5176
…	…	…	…	…	…	…	…	…	…
B-meson B±	4,5	4,5	4,5	4,5	25	$\frac{6}{3}$	$\frac{1}{2}$	10252	10329
BB-meson Y(1S)	4,5	4,5	4,5	$15{,}625 \cdot \sqrt{\frac{5}{6}}$	$15{,}625 \cdot \sqrt{\frac{5}{6}}$	$\frac{6}{3}$	$\frac{1}{2}$	18539	18510
BS-meson B^{*}_{S}	4,5	4,5	4,5	5,0568	$25 \cdot \sqrt{\frac{5}{6}}$	$\frac{6}{3}$	$\frac{1}{2}$	10516	10596

Particle	U	U	U	U	U	PC		mass calculated M_e	experim. mass M_e
CB-meson	4,5	4,5	4,5	8	$15{,}625 \cdot \sqrt{\frac{5}{6}}$	$\frac{6}{3}$	$\frac{1}{2}$	10398	
CB-meson B_C^+	4,5	4,5	4,5	9,5	$15{,}625 \cdot \sqrt{\frac{5}{6}}$	$\frac{6}{3}$	$\frac{1}{2}$	12348	12277
BS-baryon $\Xi_b\ (5945)^0$	4,5	4,5	4,5	5,557	$25 \cdot \sqrt{\frac{5}{6}}$	$\frac{6}{3}$	$\frac{1}{2}$	11556	11632
BC-baryon	4,5	4,5	4,5	8	$25 \cdot \sqrt{\frac{5}{6}}$	$\frac{6}{3}$	$\frac{1}{2}$	16637	
…	…	…	…	…	…	…	…	…	…
T-meson	4,5	4,5	4,5	4,5	$45 \cdot \sqrt{\frac{5}{7}}$	$\frac{6}{3}$	$\frac{1}{2}$	15595	
TT-meson	4,5	4,5	4,5	$27 \cdot \sqrt{\frac{5}{7}}$	$27 \cdot \sqrt{\frac{5}{7}}$	$\frac{6}{3}$	$\frac{1}{2}$	47450	
BT-baryon	4,5	4,5	4,5	$15{,}625 \cdot \sqrt{\frac{5}{6}}$	$45 \cdot \sqrt{\frac{5}{7}}$	$\frac{6}{3}$	$\frac{1}{2}$	49433	
….	….	….	….	….	….	…	…	….	….

Table 3.10: Selected particle of the 5th dimensional family

Brief evaluation of **Table 3.10** and verification result of the FSM:

It appears that superimposed harmonics of individual quark excitations from the 1st dimensional family can be used to expand these into complex particles from the 4th dimensional family onwards. It can be seen that the 5th dimensional family, which exchanges fields with each other in 5- to 6-dimensional space, is required for the production of most of the relevant known particles. Up to the third harmonic, all mesons and baryons consist of u/d-quark excitations. Only with the fourth and fifth harmonics does the particle take on its specific form. This confirms the statement that the smallest building blocks for particles consist of u/d-quarks.

There are many combinations that predict further particles. For the sake of clarity, this paper does not include all conceivable particles. A separate particle map verifies the results of all particle masses measured experimentally to date and additionally predicts further particles. This independently confirms the FSM beyond the particle model.

6th Dimension family: (power of 6 – interaction completely 6-dimensional)

The tauon electron with the particle configuration $PC = \frac{3}{3}$, the meson-boson with $PC = \frac{4}{3}$, the meson $PC = \frac{6}{3} = \frac{4-1}{3} + \frac{4-1}{3}$ and the baryon with $PC = \frac{6}{3} = \frac{4-2}{3} + \frac{4-2}{3} + \frac{4-2}{3}$ are modelled from the 6th dimension family:

Note: Please note the dimension reduction factor of $\text{Dimfactor} = \frac{5}{6}$ for the 6-dimensional space!

$$M_{tauon/electron,6.} = \frac{1}{2} [\frac{4}{3} (\frac{3}{2})^3]^6 \frac{5}{6} \frac{3}{3} M_e = 3459{,}9\ M_e \qquad (3476{,}6\ M_e \text{ experimental})$$

$$M_{meson\text{-}boson,6.} = \frac{1}{2} [\frac{4}{3} (\frac{3}{2})^3]^6 \frac{5}{6} \frac{4}{3} M_e = 4613{,}203125\ M_e$$

$$M_{meson/baryon,6.} = \frac{1}{2} [\frac{4}{3} (\frac{3}{2})^3]^6 \frac{5}{6} \frac{6}{3} M_e = 6919{,}804688\ M_e$$

Gauge bosons :

The Z- and W-bosons are so-called gauge bosons. In the Standard Model, they are responsible for the weak interaction. The Z-boson is electrically neutral, while the W-boson can assume charge states of W^+ and W^-. Both bosons have a spin of 1. The H-boson, or Higgs particle, is electrically neutral and has a spin of 0. Its interaction is weak, but the H-boson is the heaviest boson ever found.

In the particle model of the FSM, the W-, Z- and H-bosons are special products of the coupling of a muon with mass $M_{muon/electron,4.}$ from the 4th dimension family and an electron with mass $M_{electron,5.}$ from the 5th dimension family. The conglomerate of two 5- to 6-dimensional electrons in a sphere S requires the use of the 6-dimensional domain for their fion exchange. They can couple with each other as a boson pair through a fion exchange. For this purpose, the dimension reduction factor of $\text{Dimfactor} = \frac{5}{6}$ is necessary for the reference of maximum speed *c*. Both electrons are based on u/d-quarks, which, in addition to their active fions, share a number of S-quarks with the wavelength $\frac{\lambda_{u/d}}{2}$, so that the particle configuration increases from $PC = \frac{3}{3}$ to $PC = \frac{4}{4}$ for the W-boson, $PC = \frac{4{,}5}{4}$ for the Z-boson and $PC = \frac{5}{4}$ for the H-boson. The Z-boson absorbs external fions with half wavelength, which reduces the particle configuration for the particle minus the exchange fion/passive fion pair to $PC = \frac{4{,}5}{4}$. With the coupling of two fermionic $\frac{1}{2}$ spins, the heavy bosons obtain their bosonic integer spin. The process needs to be investigated in more detail to determine how a single u/d-quark transforms into two S-quarks.

W-boson :

$$M_{W\text{-}boson} = M_{muon/electron,\,4.} \cdot M_{electron,\,5.} \cdot \frac{5}{6}\, PC_{electron,4.} \cdot PC_{electron,\,5.} \cdot M_e \qquad (3.31)$$

$$M_{W\text{-}boson} \approx 205 \cdot 922{,}6 \cdot \frac{5}{6}\frac{4}{4}\frac{4}{4} M_e \approx 157642\ M_e \qquad (157376\ M_e \text{ experimental})$$

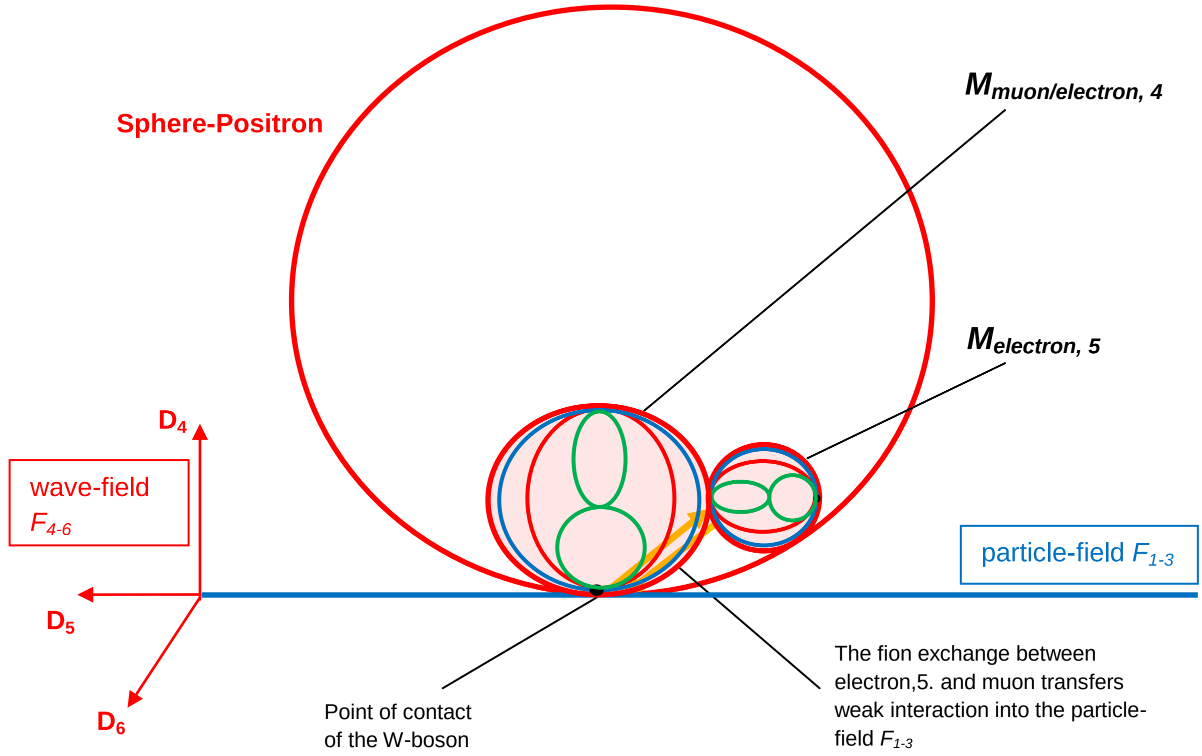


Figure 3.24: Formation of *the* W⁺-boson as a product of the masses of $M_{electron,\,5}$ and $M_{muon/electron,\,4.}$

Figure 3.24 shows the possible structure of both particles based on their spin, charge and interaction properties. The electron of the 5th dimensional family is slightly raised above the dimension plane D_{56} opposite the muon of the 4th dimensional family. Both rotate within a sphere S. If the constellation is above the dimension plane D_{56}, they rotate within a positron sphere and have a positive charge, while below the dimension plane D_{56} they rotate in an electron sphere with a negative charge. The exchange is similar to the process shown in **Figure 3.16.** The elevation of one electron to the dimension plane D_{56} causes a reduction in the field exchange of the fions because the rotation path of the exchange fions is no longer optimal for the dimension plane D_{56}. The resulting angle relative to the dimensional plane D_{56} was introduced in **Chapter 2.2** as the deviation angle β. For this particle, the fion exchange is characterized by a weak interaction rather than a strong one.

Z-boson :

$$M_{Z\text{-}boson} = M_{muon/electron,\,4.} \cdot M_{electron,\,5.} \cdot \frac{5}{6} PC_{electron,\,4.} \cdot PC_{electron,\,5.} \cdot M_e$$

$$M_{Z\text{-}boson} \approx 205 \cdot 922{,}6 \cdot \frac{5}{6}\,\frac{4{,}5}{4}\,\frac{4}{4}\ M_e \approx 177347\ M_e \qquad (178417\ M_e \text{ experimental})$$

Figure 3.25 shows the diagram for a Z-boson. It is similar to the **Figure 3.12**. Here, too, it would be unlikely for both electrons to meet at a point of contact in the dimension plane D_{56}. It is possible that both electrons are rotating rigidly at a single point within a sphere S with a positive and negative potential gradient, while being slightly elevated above the dimension plane D_{56}. In this case, the fion excange penetrates the D_{56} dimensional plane at a deviation angle of $0 < \beta < 90°$, which causes the strong interaction to transform into a weak interaction depending on this very angle.

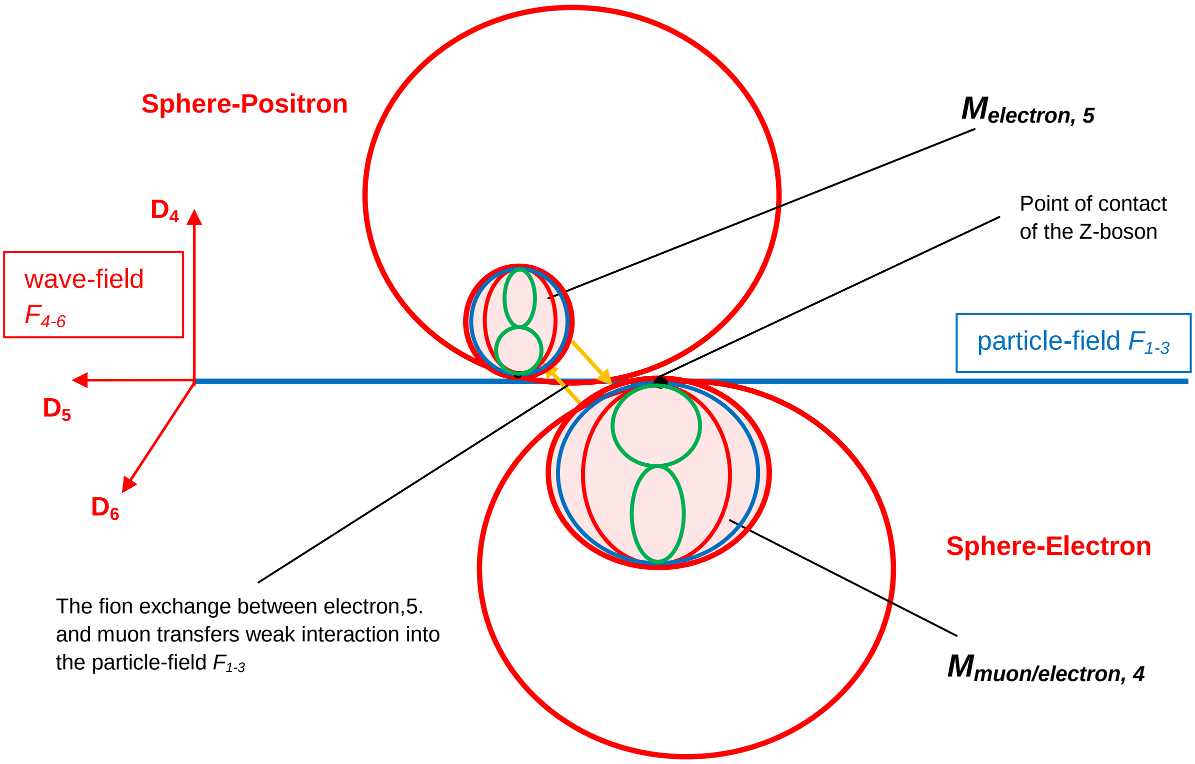


Figure 3.25: Formation of the Z-boson as a product of the masses of $M_{electron,\,5}$ and $M_{muon/electron,\,4.}$

H-boson :

$$M_{H\text{-}boson} = M_{muon/electron,\,4.} \cdot M_{electron,\,5.} \cdot \frac{5}{6} PC_{electron,\,4.} \cdot PC_{electron,\,5.} \cdot M_e$$

$$M_{H\text{-}boson} \approx 205 \cdot 922{,}6 \cdot \frac{5}{6}\,\frac{5}{4}\,\frac{4}{4}\; M_e \approx 246315\; M_e \qquad (245065\; M_e \text{ experimental})$$

Figure 3.26 shows the diagram for an H-boson. Due to its neutral total charge, it is similar to the Z-boson in that it has a structure between a positron sphere above and an electron sphere below the dimension plane D_{56}. However, the special feature of the H-boson is that it uses two active fions from an u/d-quark to generate two active S-quark pairs with a wavelength of $\frac{\lambda_{u/d}}{2}$.

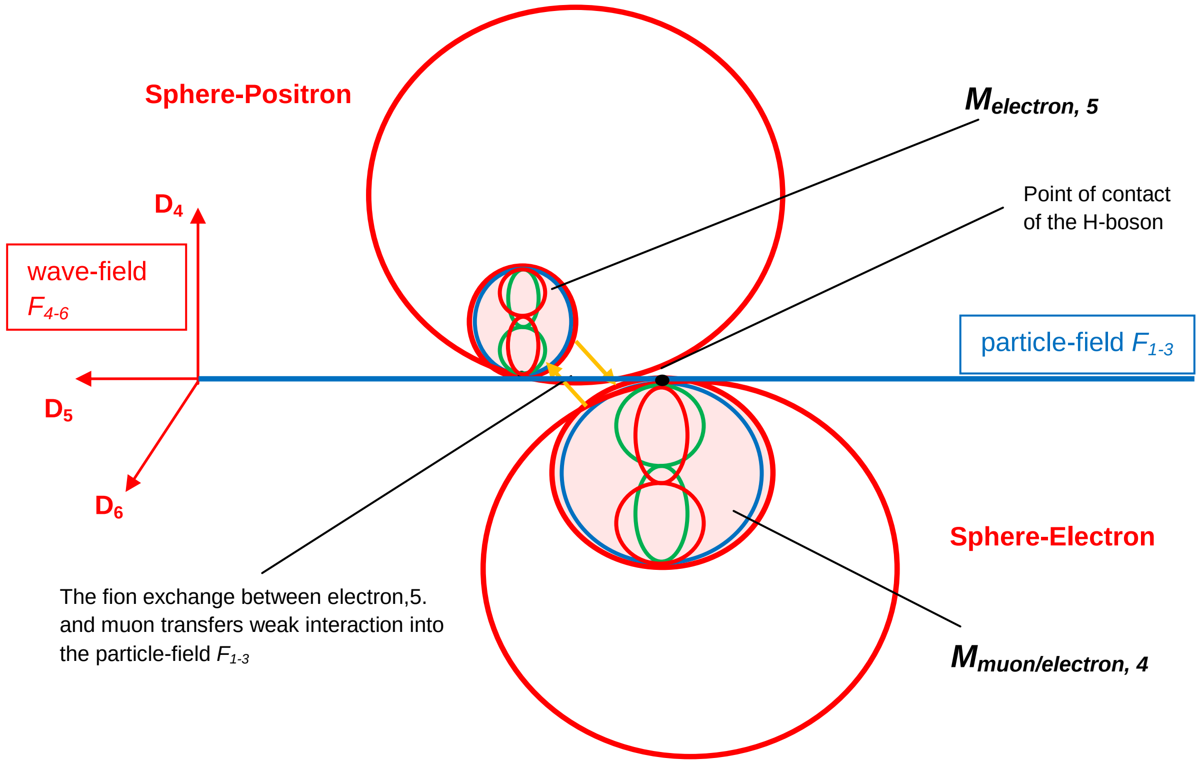


Figure 3.26: Formation of the H-boson as a product of the masses of $M_{electron,\,5}$ and $M_{muon/electron,\,4.}$