Norbert Winter

The Principle of Greatest Simplicity

in elementary particle creation

www.norbert-winter.com

www.norbert-winter.com/elementarteilchentheorie/
norbert-winter_das-gesetz-des-einfachsten.pdf

Norbert Winter, 26.05.2014

Continuation of the projects:
www.norbert-winter.com/elementarteilchentheorie.html
„Der Aufbau der Materie“, 14.04.2011
„Materie, Logik und Existenz“, 06.03.2012
„Das hochmassive skalare Boson...“, 19.04.2013

Summary:

This paper investigates the substructure of elementary particles – not just of the proton, but of all particles that have been physically observed. More fundamentally, this paper asks the question: it is even possible for a “most elementary object” to exist, meaning an object that cannot be further decomposed into components that are more elementary still. It is then natural to inquire about the nature of such an elementary object – if it does in fact exist – which elementary criteria does it fulfil? How does it generate all existing, physically observable particles? Which individual, concrete stages play a role in this creation process? Can this process create other elementary particles that have not yet been observed? Does this most elementary particle possess physically measurable properties such as mass, charge, force interactions, force magnitudes…?

In order to answer these questions, the **elementary particle creation process** will be presented in detail. The underlying causes of the process will be identified, showing how these creation processes arise, and how a series of different structuring and formation processes combine to make **each individual elementary particle**. It will be shown how this creation process results in the complete spectrum of known elementary particles, namely the **elementary fermions** $\textcircled{p^+}$, $\textcircled{e^-}$, $\textcircled{v}$, **the elementary bosons** $\textcircled{St}$, $\textcircled{\gamma}$, $\textcircled{Z}$ for the strong, electromagnetic and weak interactions, and the **graviton** $\textcircled{G}$ for the gravitational force, with a derivation of all associated properties such as mass, charge, force interactions and force magnitudes… A remark discussing the **quantitative completeness** of the overall process is included. To put it colloquially: “Nothing is swept under the carpet” and “Nothing is magically pulled out of a hat”, which should hopefully be clear anyway at each step. First of all, three elementary criteria **EK 1, EK 2 and EK 3** will be established. Of these three criteria, **EK 3** ≡ **Principle of Greatest Simplicity** is the most significant, as it drives the whole creation process. From these elementary criteria, the simplest fundamental interaction possible will be derived, and it will be shown that this fundamental interaction intrinsically contains, straight from the definitions, the point split σ with limit value $\sigma \rightarrow 0$, as a result of the presence of the differential operator $\mathbf{D} \equiv \frac{\mathbf{d}}{\mathbf{dx}}$**, where** $\mathbf{dx} = \boldsymbol{\sigma}$ **and** $\boldsymbol{\sigma} \rightarrow \mathbf{0}$. This **point split** $\boldsymbol{\sigma}$ will determine and then trigger the **matter construction process**.

This construction process, occurring in the point split-separated local neighbourhood $\textcircled{x,\sigma}$ will then be studied in complete detail, and each of its constituent stages will be presented. It will be shown that the spinors involved in this fundamental interaction $\boldsymbol{D\Psi = \Psi \overline{\Psi} \Psi}$ necessarily possess a **length dimension of** $\mathbf{-\frac{1}{2}}$ due to the length dimension of the differential operator $\boldsymbol{D}$ (by definition, $\boldsymbol{Dim\ D} = -1$).

Thus, they do not represent canonical observables and the physically observable elementary fermions $\textcircled{p^+}$, $\textcircled{e^-}$, $\textcircled{v}$ must **all** be $\textcircled{\Psi^{\textcircled{3}}}$-objects, the elementary bosons $\textcircled{St}$, $\textcircled{\gamma}$, $\textcircled{Z}$ (for the strong, electromagnetic and weak interactions) must be $\textcircled{\Psi^{\textcircled{2}}}$-objects, and the graviton $\boldsymbol{G}$ (gravitational interaction) must be a $\textcircled{\Psi^{\textcircled{4}}}$–object.

The **elementary particle creation process** that opens with the construction process can be subdivided into four fundamental subprocesses:

In the 1st fundamental process, the $\Psi^{⑨}(x,\sigma_4)$ is created, giving rise to quantization $\hbar$, as well as 4-dimensional (space-time) structure.

In the 2nd fundamental process, an unstructured spinor complex $\Psi^{㉗}(x,\sigma_{13})$ is created, from which, by means of

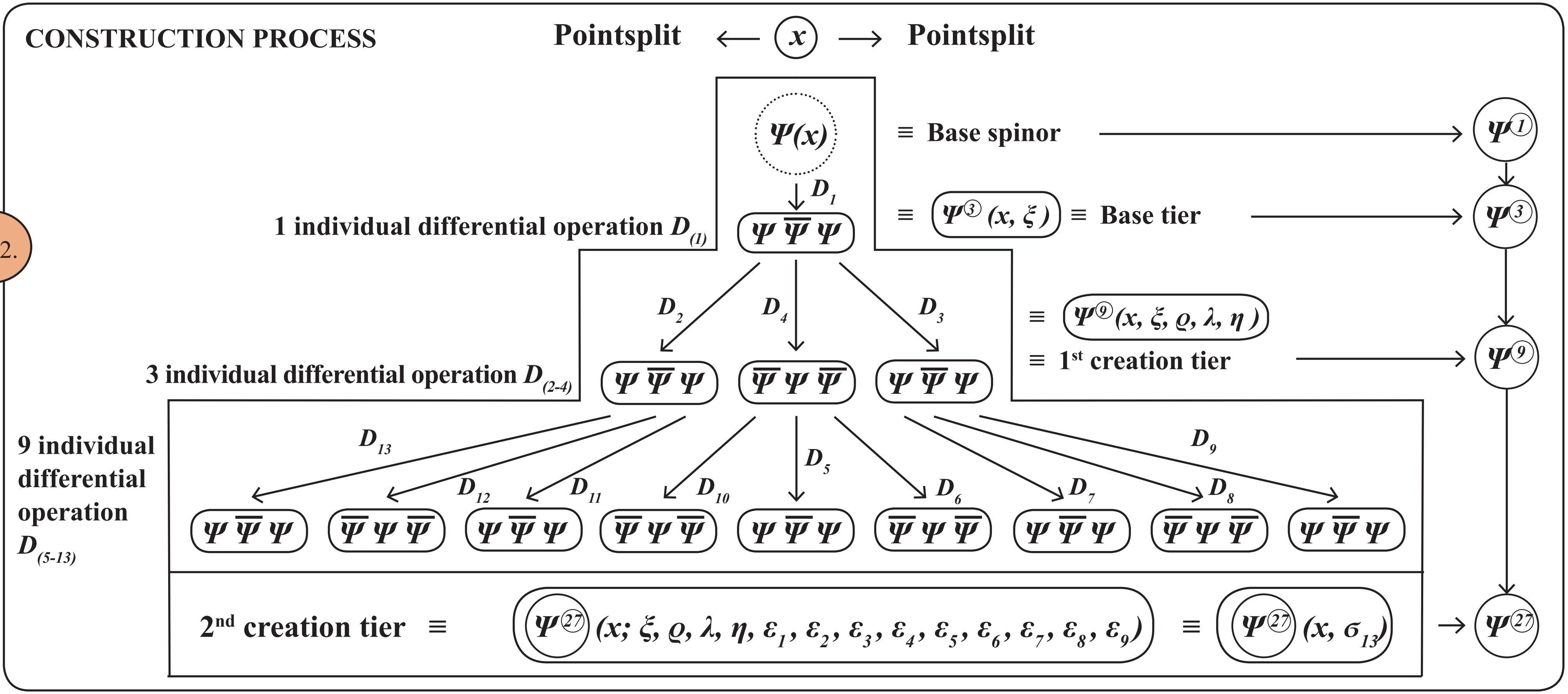
the 3rd fundamental process, the structuring frame $\Psi^{⑧}$ (separation and binding) is formed, such that

in the 4th fundamental process, by the action of the structuring frame $\Psi^{⑧}$ within the unstructured spinor complex $\Psi^{㉗}(x,\sigma_{13})$ a structured spinor complex $\underset{\wr\cup}{\Psi}^{⑲}(x,\sigma_{13})$ is created.

From this structured spinor complex $\underset{\wr\cup}{\Psi}^{⑲}(x,\sigma_{13})$ – set in motion by the structuring frame $\Psi^{⑧}$ and the **dynamically generated point split structure** – the 3 elementary fermions are formed, $p^+ = \Psi\,\Psi\,\overline{\Psi}$, $e^- = \overline{\Psi}\,\Psi\,\Psi$, $\nu = \Psi\,\overline{\Psi}\,\Psi$, as well as the 3 elementary bosons $St = \Psi\,\Psi$, $\gamma = \overline{\Psi}\,\Psi$, $Z = \Psi\,\overline{\Psi}$, corresponding to the strong, electromagnetic and weak interactions respectively, and the graviton $G = \overline{\Psi}\,\overline{\Psi}\,\overline{\Psi}\,\overline{\Psi}$, corresponding to the gravitational interaction.
Once these elementary particles are formed, the structured spinor complex $\underset{\wr\cup}{\Psi}^{⑲}$ will have been completely consumed. From the point split structure generated in each of the $\underset{\wr\cup}{\Psi}^{⑲}$-objects during the dynamic construction process via **Separation-Binding**, a set of properties are constructed, enabling the resulting elementary particles to be classified. These properties include: the generation of mass at a **collision threshold ≡ point split density ≥ 2 point splits**, the generation of charge at a **penetration threshold = point split density ≥ 3 point splits**, together with a classification by **quantity** (for mass) or **magnitude** (for forces) that is dependent on the coherency properties of the internal base spinors of each elementary particle. Since the elementary particle creation process is the **most elementary process** within the scope of physics, there arise **universal structure constants** during each individual phase of the creation process: e.g. **quantization** $\hbar$ as a structure constant of the $\Psi^{⑨}(x,\sigma_4)$-generation; the **creation of space-time structure** initiated by the **4th** fundamental split $(\xi, \varrho, \lambda, \eta) = \sigma_4$ in the $\Psi^{⑨}(x,\sigma_4)$-complex; the **speed of light** c as a structural inertia constant of the elementary construction process (first p^+, then e^-).

Overview of the most important stages of the process: the elementary particle creation process arises as shown here (each number refers to the relevant section of this document): first, the construction process, I.12. and III.4.1., followed by the structuring and formation processes VII.66. .

I.12.

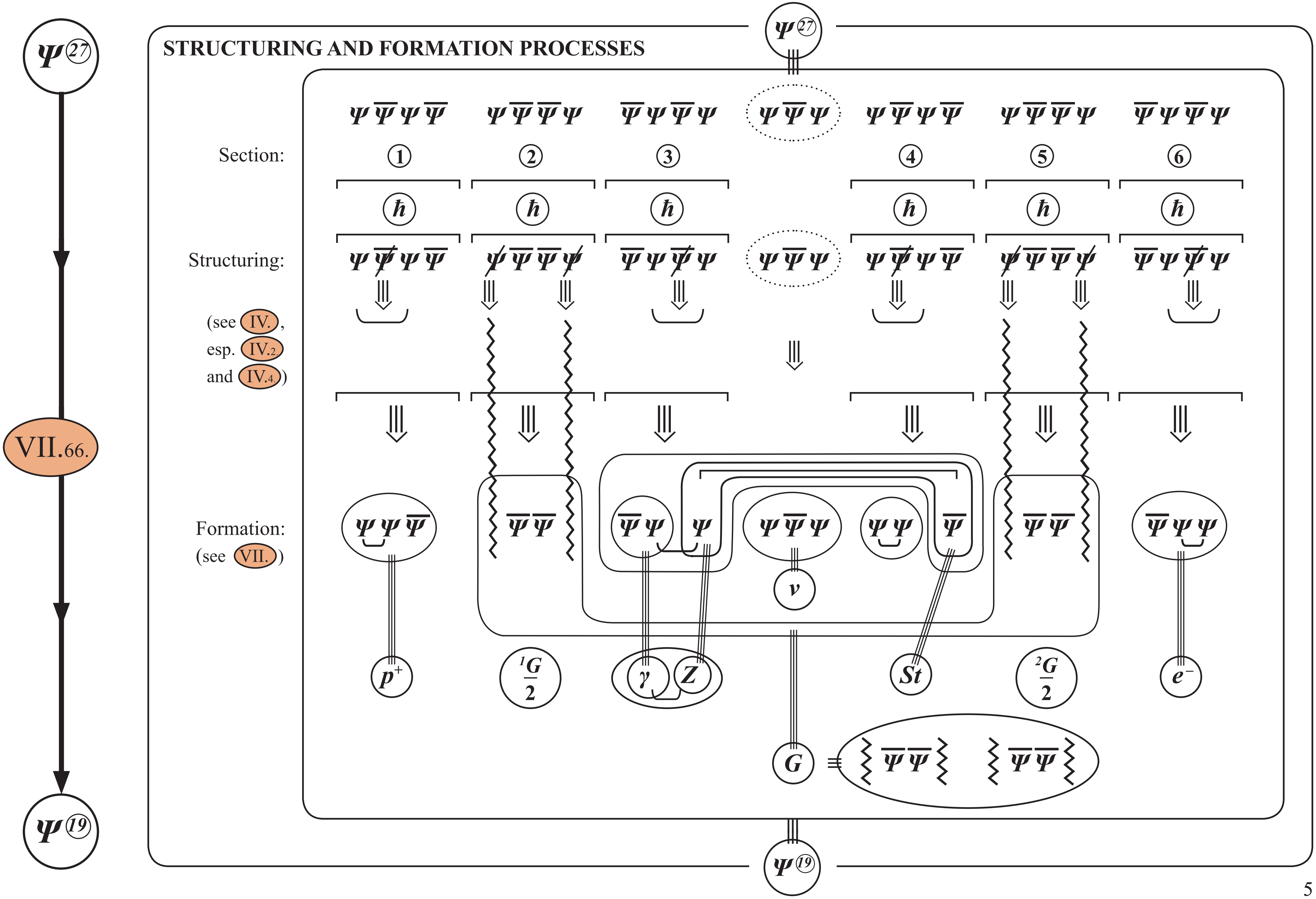


Considerimg the effective local layout of the split-open 1st creation tier $\Psi^{⑨}(x,\sigma_4)$ as well as the – according to III.1. → III.4. – split-open generated 2nd creation tier $\Psi^{㉗}(x,\sigma_{13})$, the local layout is:

III.4.1.

$\Psi^{㉗}$

Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ	Ψ	$\overline{\Psi}$	Ψ	Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
$-\xi -\varrho$	$-\xi -\varrho$	$-\xi -\varrho$	$-\eta$	$-\eta$	$-\eta$	$-\xi$	$-\xi$	$-\xi$	$-\xi +\varrho$	$-\xi +\varrho$	$-\xi +\varrho$	0	0	0	$+\xi -\lambda$	$+\xi -\lambda$	$+\xi -\lambda$	$+\xi$	$+\xi$	$+\xi$	$+\eta$	$+\eta$	$+\eta$	$+\xi +\lambda$	$+\xi +\lambda$	$+\xi +\lambda$
$-\varepsilon_9$	0	$+\varepsilon_9$	$-\varepsilon_8$	0	$+\varepsilon_8$	$-\varepsilon_7$	0	$+\varepsilon_7$	$-\varepsilon_6$	0	$+\varepsilon_6$	$-\varepsilon_1$	0	$+\varepsilon_1$	$-\varepsilon_2$	0	$+\varepsilon_2$	$-\varepsilon_3$	0	$+\varepsilon_3$	$-\varepsilon_4$	0	$+\varepsilon_4$	$-\varepsilon_5$	0	$+\varepsilon_5$


Ψ ㉗
VII.66.
Ψ ⑲
STRUCTURING AND FORMATION PROCESSES
Section:
① ② ③ ④ ⑤ ⑥
ħ
Structuring:
(see IV., esp. IV.2. and IV.4.)
Formation:
(see VII.)
p+
1G/2
γ Z
ν
St
2G/2
e−
G ≡

This is followed by the creation of the individual elementary particles:

VII.70.

Proton:	$\enclose{circle}{p^+}$	$\equiv$	$\boxed{\underset{\cup}{\Psi\Psi}\overline{\Psi}\ \ (-\xi, -\varrho, -\varepsilon_8, \enclose{circle}{\pm\varepsilon_9})}$	$\equiv$	**(3-base spinor)-(4-split)-object**	**(1 $\hbar$)**
Electron:	$\enclose{circle}{e^-}$	$\equiv$	$\boxed{\overline{\Psi}\underset{\cup}{\Psi\Psi}\ \ (+\eta, +\varepsilon_4, \enclose{circle}{\pm\varepsilon_5})}$	$\equiv$	**(3-base spinor)-(3-split) -object**	**(1 $\hbar$)**
Neutrino:	$\enclose{circle}{\nu}$	$\equiv$	$\boxed{\Psi\overline{\Psi}\Psi\ \ (\enclose{circle}{\pm\varepsilon_1})}$	$\equiv$	**(3-base spinor)-(1-split) -object**	**(1 $\hbar$)**
Strong interaction:	$\enclose{circle}{St}$	$\equiv$	$\boxed{\underset{\cup}{\Psi\Psi}\ \ (-\lambda, \enclose{circle}{\pm\varepsilon_2})}$	$\equiv$	**(2-base spinor)-(2-split) -object**	**(1 $\hbar$)**
Electromagnetic-weak interaction:	$\enclose{circle}{\enclose{circle}{\gamma}\cup\enclose{circle}{Z}}$	$\equiv$	$\boxed{\enclose{circle}{\overline{\Psi}\Psi}\cup\enclose{circle}{\overbrace{\Psi\qquad\overline{\Psi}}}\ \ (-\varepsilon_3, \enclose{circle}{\pm\varepsilon_6}, +\varepsilon_7)}$	,		**(1 $\hbar$)**

with the following two distinct components, coupled together by „ ∪”,
but still independently existing (see VII.23. to VII.33)

	$\enclose{circle}{Z}$	$\equiv$	$\boxed{\overbrace{\Psi\ \dots\ \overline{\Psi}}\ \ (+\varepsilon_6, -\varepsilon_3)}$	$\equiv$	**(2-base spinor)-(2-split) -object**	
	$\enclose{circle}{\gamma}$	$\equiv$	$\boxed{\enclose{circle}{\overline{\Psi}\Psi}\ \ (+\varepsilon_7)}$	$\equiv$	**(2-base spinor)-(1/0-split)-object**	
Gravitational interaction:	$\enclose{circle}{G}$	$\equiv$	$\boxed{\wr\,\overline{\Psi}\,\overline{\Psi}\,\wr\quad\wr\,\overline{\Psi}\,\overline{\Psi}\,\wr\ \ (-\varepsilon_7)}$	$\equiv$	**(4-base spinor)-(0/1-split)-object,**	**(1 $\hbar$)**

with $\gamma\,/\,G$ association, see VII.46.

Chapter VIII.2. describes the sequence of processes involved in the creation of individual elementary particles, from which a systemic relation between matter and forces, coherent with real, experimental results, will be derived in Chapter VIII.3.. See VIII.3.2. :

VIII.3.2.

From the sequence of processes in VIII.2.2.: 1st, 2nd, 3rd, 4th a systemic relation between elementary particles and elementary forces arises as follows:

Elementary fermions	Types of interaction			
	strong	electromagnetic	weak	gravitational
Proton p^+	yes	yes	yes	yes
Electron e^-	no	yes	yes	yes
Neutrino ν	no	no	yes	no

with magnitudes as described VIII.1..

This gives the:

Overall force structure

VIII.3.3.

All of the individual interactions (strong, electromagnetic-weak, gravitational) are systemically interrelated. In other words, the "great unification" of strong and electromagnetic-weak interactions, and the even "greater unification" of strong, electromagnetic-weak and gravitational interactions is system-intrinsic and possesses well-defined structure. The individual components and the system as a whole are presented in Chapter VII..

Table of contents:

Chapter I. **Basic principles:**

Elementary criteria (Principle of Greatest Simplicity), fundamental interaction, point split, identity principle

It is well-known and has been physically verified in many different ways that all existing matter is built from so-called elementary particles:

Elementary particles → Atoms → Molecules → Macromolecules →...

These elementary particles (matter particles and force-carriers) have been subjected to extensive experimental scrutiny – for example at Cern – although future surprises cannot of course be completely ruled out.
Despite this impressive level of knowledge, there is an ancient, ever-reoccurring question that remains unresolved:

- **Does there exist an elementary base structure, something that cannot be decomposed into components that are more elementary still? If a "most elementary object" does exist, what are its characteristics?**

As well as the question:

- **Is there an intrinsic mechanism to this elementary base structure that initiates the necessary construction processes, effectively and deterministically resulting in the generation of all physically observable elementary particles (matter particles and force carriers)?**

  If this single elementary particle creation process does exist,

  what kind of unified elementary particle theory might best describe it?

Today, everybody agrees that elementary particles have substructure – or at the very least some particles do, such as the proton. The best-known and most successful model for describing elementary particle substructure is known as the standard model (Gell-Mann, Fritzsch, and others…), which builds heavily upon the concept of quarks.

This document adopts an alternative approach.
The first step in such an endeavour is to establish the elementary criteria that govern the structure of any “most elementary object” – whatever that may mean.

These elementary criteria are:

I.0.1.

Elementary criterion ① (hereafter denoted EK 1):
There exists an elementary particle creation process, i.e. elementary particles don’t “just exist”, but are the effective result of a construction process that is intrinsic to them.

This means: Elementary particles themselves possess substructure, and are themselves the result of a strictly fundamental construction process from more fundamental components. This is true not just for the proton p^+, but equally for the electron e^-, the neutrino ν, the elementary bosons St, γ and Z and the graviton G.

I.0.1.1.

The elementary criterion ① stated above prompts the question: What are these fundamental components?

I.0.2.

Elementary criterion ② (hereafter denoted EK 2):
This elementary particle creation process I.0.1. is strictly of a fundamentally dynamic nature.

This means: the act of elementary particle creation must result from a strictly non-linear force structure between the fundamental components mentioned in I.0.1.1. If this were not the case, the existing elementary particles would not be created from more fundamental components, contradicting I.0.1.

I.0.2.1.

Given the elementary criterion ①, the elementary criterion ② prompts the question:

What might this strictly non-linear force framework look like, given that by means of a – potentially multistage – construction mechanism it leads to the creation of all of the elementary particles?

I.0.3.

Elementary criterion ③ (hereafter denoted EK 3):
The elementary particle creation process is governed by the Principle of Greatest Simplicity, which could also be called the Minimality Principle.

This means: If the elementary particle creation process possessed a structure more complex than the simplest structure possible, then it could be decomposed into even simpler processes, contradicting the assumption that it is the most fundamental process.

Thus: Elementary particle creation must strictly adhere to the Principle of Greatest Simplicity (Minimality Principle), even if the process itself possesses multiple stages.

I.0.4.

Given the elementary criteria ①+②+③, (see I.0.1., I.0.2., I.0.3.)
the creation process must be a:

unified process that generates the complete range of elementary particles (matter particles and force carriers), together with all their associated properties: mass, charge, types of force they interact with, magnitudes of these forces, etc. ...

Nothing more, and nothing less.

The presentation of the elementary particle creation process will follow the structure of the process itself, and so will be organised into multiple distinct sections. Each successive chapter will build upon the last:
Chapter I → Chapter II → Chapter III → ... Chapter IX .

The material covered ranges from the identification of multiple, successively occurring fundamental processes and their end-products, up until the creation of each individual elementary particle, including all intrinsic properties characteristic to that particle .

That's the plan – it starts now. The beginning of Chapter I. is the first step of the presentation, which starts by identifying the most fundamental building block of all – the starting point for everything else.

The building block thus identified provides an answer to question I.0.1.1., which asks:
What are the most fundamental components in the elementary particle creation process? The answer is as follows:

I.0.5.

In order for the Principle of Greatest Simplicity (the Minimality Principle) to hold – as laid out in I.0.1. and EK 3 – the underlying fundamental building block (see I.0.1.1.) must be the most general physical-mathematical entity possible. This implies: The fundamental building block must be a spinor Ψ because spinors are the only object that have the property that all other types of physical-mathematical objects such as scalars, vectors, tensors, higher-order spinors etc. can be constructed from them by taking products.

Only spinors Ψ can recreate the full range of these objects by taking products. No other mathematical object has this property.
Given the Principle of Greatest Simplicity (Minimality Principle) I.0.3. therefore, the fundamental building blocks must be spinors Ψ as this is the only way that all other physical entities can be constructed, without requiring anything else – in this way, the Minimality Principle is satisfied.

Thus: in the elementary particle creation process, from a strict application of the Principle of Greatest Simplicity (Minimality Principle) I.0.3., the only objects that exist are the base spinors Ψ – nothing else. There are no other fundamental building blocks.

Assuming the elementary criteria I.0.1. → I.0.3. and their derived consequences I.0.4. and I.0.5.:

The elementary particle creation process must be fundamentally dynamic in nature, thus satisfying I.0.2., meaning that the base spinors Ψ from I.0.5. can only exist within a strictly non-linear framework of forces. Applying the Principle of Greatest Simplicity (Minimality Principle) from I.0.3., this interaction framework must have the simplest structure possible.

This also gives an answer to the question outlined in I.0.2.1.. Taking $D \equiv \frac{d}{dx}$ to be the differential operator gives:

The fundamental dynamic underlying the elementary particle creation process is:

I.1.
$$D_x \Psi(x) = \Psi(x-\sigma_1) \; \overline{\Psi}(x) \; \Psi(x+\sigma_1) \; ; \qquad \sigma_1 \equiv \text{point split, where } \sigma_1 \rightarrow 0$$

I.2.
$$D_x \overline{\Psi}(x) = \overline{\Psi}(x-\sigma_2) \; \Psi(x) \; \overline{\Psi}(x+\sigma_2) \; ; \qquad \sigma_2 \equiv \text{point split, where } \sigma_2 \rightarrow 0$$

For the presentation of this non-linear spinor dynamic I.1., I.2. a discussion of the σ-algebras and γ-algebras automatically inherited by Weyl and Dirac spinors respectively will be omitted, firstly because these algebras are well-known and easy to understand, and secondly because – as will become apparent over the course of the paper – the elementary processes naturally give rise to relatively high-order spinor products, specifically Ψ⑨ and Ψ㉗ in the split-separated local neighbourhood x,σ. Including a discussion of the automatically inherited σ- or γ-structure would render the document unnecessarily confusing, distracting from the more important aspects.

Side-remark:

The fundamental equation I.1., I.2. is structurally similar to the Equation of Matter suggested in 1958 by Werner Heisenberg, subsequently given the name of "World formular" (an expression that was not coined by Heisenberg) in the literature, the name by which it later become known to the general public:

Heisenberg's Equation of Matter, 1958: $\gamma_{\nu} \frac{\partial}{\partial x} \text{-} \Psi \pm l^2 \gamma_{\mu} \gamma_5 \Psi (\overline{\Psi} \gamma_{\mu} \gamma_5 \Psi) = 0$

is structurally identical to I.1., I.2., except for two significant differences:

1st difference: The Heisenberg equation, 1958, contains a dimensionful coupling constant l^2 (≡ “fundamental distance”), as this is the only way the spinors Ψ can satisfy the canonical commutativity relations and thus represent observable physical objects. However, the inclusion of a dimensionful coupling constant contradicts the Minimality Principle, I.0.3. , which is taken as a fundamental requirement in the present document: the only fundamental objects that exist are I.1., I.2. and nothing else. This means that all physical, universal constants such as $\hbar$, c and the Planck length are secondary constructions derived from I.1., I.2.. Heisenberg himself, along with many other physicists, was always a proponent of the simplest solution.

2nd difference: The 2nd difference is far more consequential than the first. The Heisenberg equation shown above does not contain the point split σ, despite being a differential equation. But as a differential equation, a point split term $D \equiv \dfrac{\mathrm{d}}{\mathrm{dx} \equiv \sigma}$ is actually automatically present on the left-hand side, from the definition of the differential operator $\mathrm{dx} \equiv \sigma$. As an equation, there should therefore also be a point split σ on the right-hand side, in the limit. Directly from the fact that there is a point split σ in I.1., I.2., where $\sigma \rightarrow 0$, without requiring any other assumptions, it will be shown in I.12. that all of the successive stages of the

construction process $\Psi \longrightarrow \Psi^{③} \longrightarrow \Psi^{⑨} \longrightarrow \Psi^{㉗}$ are triggered in series in the split-separated local

neighbourhood (x,σ_{13}) including an intrinsic structuring process. The point split closing process $\sigma \rightarrow 0$ then completes the creation of the full range of elementary particles. All of these processes will be described in detail throughout the following chapters. Everything can be traced back to the point split σ. Yet this point split does not appear in Heisenberg’s 1958 Matter Equation.

Thus: The physical interpretation of the point split σ in I.1. and I.2. is justified by the observation that the fundamental interaction $D\,\Psi = \Psi\,\overline{\Psi}\,\Psi$ and $D\,\overline{\Psi} = \overline{\Psi}\,\Psi\,\overline{\Psi}$ cannot occur at a given fixed point x, as a “fixed point” presupposes an external frame of reference, requiring additional assumptions. There are, however, no other assumptions in the context of the fundamental creation process. Also, the differential operation D, which initiates the interaction, is defined by a differential quotient $\frac{d}{dx}$, and presupposes a point-splitting process – dx is nothing other than a point split. So, the existence of a fundamental force structure implies the existence of the differential operation $D \equiv \frac{d}{dx}$, which in turn implies the existence of the point split σ.

I.3.

From the fundamental interaction: $D\,\Psi = \Psi\,\overline{\Psi}\,\Psi$ and $D\,\overline{\Psi} = \overline{\Psi}\,\Psi\,\overline{\Psi}$, it follows that:
From its definition, the differential operator D has a so-called length dimension equal to -1
(Definition: *dim D* = -1). The fundamental interaction then implies that:

Length dimension of Ψ $= -\frac{1}{2}$; *dim* $\Psi = -\frac{1}{2}$ Length dimension of $\overline{\Psi}$ $= -\frac{1}{2}$; *dim* $\overline{\Psi} = -\frac{1}{2}$

It follows that: The base spinors $\Psi(x)$ and $\overline{\Psi}(x)$ are not observable objects. Observable objects have the following properties:

- **observable fermions (p^+, e^-, ν) have dimension $-\frac{3}{2}$, i.e. [*dim* Fermion] $\equiv \frac{3}{2} \cdot$ [*dim D*]**
- **observable bosons (γ, Z ($W^\pm$), St) have dimension -1, i.e. [*dim* Boson] $\equiv$ 1 · [*dim D*]**
- **observable energy$\oplus$momentum formations $E\oplus I$ have dimension -2, i.e. [*dim* $E\oplus I$] $\equiv$ 2 · [*dim D*]**
  where the dimension of energy is -1, i.e. [*dim* Energy] $\equiv$ 1 · [*dim D*]
  and the dimension of momentum is -1, i.e. [*dim* Momentum] $\equiv$ 1 · [*dim D*]

Hence the spinor products formed by the fundamental interaction I.1. and I.2. must be:

- **observable fermions ($\Psi^{\textcircled{3}}$), i.e. the proton p^{+}, electron e^{-}, neutrino ν,**
  where $p^{+} = \Psi\,\Psi\,\overline{\Psi}$, $e^{-} = \overline{\Psi}\,\Psi\,\Psi$, $\nu = \Psi\,\overline{\Psi}\,\Psi$

- **observable bosons ($\Psi^{\textcircled{2}}$), i.e. the electromagnetic interaction γ,**
  the weak interaction $Z\,(W^{\pm})$, the strong interaction St,
  where $\boxed{\gamma = \overline{\Psi}\,\Psi}$, $\boxed{Z = \Psi\,\overline{\Psi}}$, $\boxed{\textbf{strong boson } St = \Psi\,\Psi}$

- **observable graviton ($\Psi^{\textcircled{4}}$), corresponding to the gravitational interaction G,**
  where $G = \overline{\Psi}\,\overline{\Psi}\,\overline{\Psi}\,\overline{\Psi}$

- **observable energy$\oplus$momentum formations ($\Psi^{\textcircled{4}}$), corresponding to various $E\oplus I$,**
  where for example $E\oplus I = \overline{\Psi}\,\Psi\,\Psi\,\overline{\Psi}$

The notation ***($\Psi^{\textcircled{n}}$)*** where ($n = 1, 2, 3, 4$) denotes a spinor product of n spinors, potentially including both Ψ and $\overline{\Psi}$ terms, ***($\Psi^{\textcircled{n}}$)*** where ($n > 4$) denotes a spinor grouping of n spinors ($n > 4$) in the split-separated local neighbourhood of $x + \sigma_{\nu}$, potentially including both Ψ and $\overline{\Psi}$ terms, so that the Pauli exclusion principle is not violated for any given split σ_{ν}.

Although the observable elementary particles must be constructed from spinor products, they must also be identifiable as “particles”, and so must be individualised. Hence, there must exist an individualising energy⊕momentum, which determines each individual elementary particle as a characterisable, individualised physical object which can then be identified.

The same must be true for each physical energy⊕momentum object itself, which has deep physical consequences:

Hence: In order to be itself determined – in other words for the determination of its own identity – the physical energy⊕momentum object requires a second energy⊕momentum object from which it draws its individualising energy⊕momentum, thus enabling it to exist as a determinable object. And vice versa.

I.4.

$$\begin{tikzcd} (E \oplus I)_1 \arrow[r, bend left] & (E \oplus I)_2 \arrow[l, bend left] \end{tikzcd}$$

➡

This has a fundamentally dynamic consequence:

The following dynamic identity principle must hold in the elementary particle creation process:

I.5.

- **In the elementary creation process, no two exactly identical elementary objects are ever created.**
- **Whenever a situation arises in the elementary, dynamic creation process that might allow the creation of two identical objects, the dynamic process is activated by the fundamental dynamic I.1. and I.2., forcing the system to be**

I.5.1.

- **dynamically extended, or restructured (in the sense of the characteristic relationships between base spinors),**

I.5.2.

- **so that, by means of this extension or restructuration, no two (or more) objects are effectively ever created to be identical.**

In this way, the identity principle I.5. is consequently the "MOST FUNDAMENTAL LOGICAL-ONTOLOGICAL PRINCIPLE" and becomes the "grand architect" of the physical creation process of elementary particles and fundamental forces.

Throughout the rest of the presentation, the identity principle I.5. will be referenced each time that it inherently acts upon the particle creation process.

I.6.

The necessary condition I.4.: $$\begin{tikzcd} (E\oplus I)_1 \arrow[r, bend left] & (E\oplus I)_2 \arrow[l, bend left] \end{tikzcd}$$ **leads to – by the action of the identity principle I.5. and the resulting extension I.5.1., and driven by the fundamental dynamic I.1. and I.2. – a multistage creation process producing spinor complexes in the split-separated neighbourhood x,σ of the local origin x.**

This creation process proceeds, subject to the Principle of Greatest Simplicity (Minimality Principle) I.0.3., until there is a sufficient quantity of raw spinor material to fulfil the following two necessary conditions for elementary particle creation:

I.7.

I.7.1.

<u>Elementary particle creation condition</u> ① ≡ ET 1:

The raw spinor material generated by the fundamental dynamic I.1. and I.2. must be structurable, in order to allow the formation – via a structuring process – of identifiable, physical objects.

In other words, there must be sufficient raw spinor material to form the energy and momentum agents necessary for structuring to take place.

I.7.2.

<u>Elementary particle creation condition</u> ② ≡ ET 2:

Once the post-creation spinor-structuring process is complete, and the structuring agents have formed, and once the process-critical structuring momentum and energy have been consumed and fully exploited by the structuring process, there must be sufficient dynamically generated raw spinor material left over to form the individual, observable and thus identifiable elementary particles.

I.7.

I.7.2.

For identifiable elementary particles, this means that the requirements of the canonical commutativity relations must be fulfilled, so that they are identifiable as observable, physical particles:

This means that, for example, the elementary fermions (e.g. proton p^+, electron e^-, neutrino ν) must have canonical length dimension equal to $-\frac{3}{2}$.

Given that, from I.3. the base spinors Ψ (and $\overline{\Psi}$) have length dimension equal to $-\frac{1}{2}$, the observable elementary fermions (protons, electrons and neutrinos) must each be formed from a product of exactly three base spinors.

An analogous relation holds for the elementary bosons: the electromagnetic interaction γ, the weak interaction Z, and the strong interaction St must each have dimension equal to -1 in order to be identifiable as observables. Consequently, each of the bosons γ, Z, St must be formed from a spinor product of exactly 2 base spinors.

Specifically, these conditions have the following consequences for the creation of elementary particles:

Discussion of ET 1:

Any structuring mechanism must necessarily proceed by splitting the target object into separated components, and then binding these components together.

I.8. **Thus: every structuring process can be organised into distinct “separation” and “binding” phases. Each of these phases requires dedicated structuring momentum and energy. Thus: in the elementary particle creation process, there must form**

separation momentum and separation energy,
binding momentum and binding energy

and these resources must somehow be exploited.

Since – as is well-known – momentum and energy both have length dimension -1, for the structuring processes of separation and binding to successfully proceed, a spinor subset with the following dimensions must be available:

I.8.

I.8.1.

Process	⟹	**separation momentum**	+	**separation energy**	+	**binding momentum**	+	**binding energy**	≡	**sum total**
		⇓		⇓		⇓		⇓		⇓
Length dimension	⟹	-1	+	-1	+	-1	+	-1		-4

⇓

Thus: the overall structuring process requires a spinor subset with overall length dimension equal to -4

⟹ **Hence: the supply of raw spinor material generated from I.6. must include a subset of spinors with dimension -4 dedicated to the structuring process. This must be the spinor subset Ψ⑧ giving [*dim* Ψ⑧] = [*dim* -4], as from I.3. each base spinor Ψ has dimension $-\frac{1}{2}$, $dim\ \Psi = -\frac{1}{2}$.**

I.8.

I.8.2.

Discussion of ET 2:

Only once the structuring process (separation and binding) is complete, and once the primitive spinor material has been accordingly structured into isolated components, can the

formation of individual, identifiable and thus physically observable entities proceed – no sooner.

These entities can be called “elementary particles”, and can then be individually classified as

fermions Ψ③ , bosons Ψ② , graviton Ψ④′ , ...

The formation of these physical entities occurs through the use of “blank precursors” , so that, initially, each particle consists of nothing more than a structural delimitation .

The intrinsic properties of the physical objects obtained so far (blank elementary particles precursors) are:

Mass, charge, types of force that interact with the object, magnitudes of these forces, ...

These intrinsic properties of elementary particles form at a later stage, after the structuring phase is complete. The dynamically generated point split groupings will later acquire relations and mass, so that each individual grouping, which initially is devoid of structure except for that inherited from separation and binding, acquires a characteristic point split density that can later be definitively classified.

I.8. I.8.2.

Thus: The end-result is a characteristic set of properties (mass, charge, force interactions…) – arising from the internal creation mechanism intrinsic to each elementary particle – resulting from the internal, dynamically generated, point split structure of each elementary particle. This process makes the elementary particles what they are, endowing them with characteristic properties by which they can be identified.

The significance of dynamically arising point split densities in the systemic development of the physical properties of elementary particles is, as far as I know, discussed for the first time in this document. If this approach is explored in any other body of work, I would be grateful for more information.

So: The elementary particle creation conditions ET 1, ET 2, (I.7. and I.8.) give a lower bound for the quantity of raw spinor material I.6. that the fundamental dynamic I.1. and I.2. must produce in the split-open local neighbourhood x,σ .

I.9.

Required quantities:

to fulfil ET 1 (structuring of spinor groupings) (see I.7.): exactly 8 base spinors

to fulfil ET 2 (creation of individual elementary particles) (see I.7.) .), an additional:

for each elementary fermion to be generated: 3 base spinors
for each elementary boson to be generated: 2 base spinors

so, assuming only the existence of a single elementary fermion
e.g. for the proton p^+, at least: 3 base spinors

The total quantity of spinor material I.6., I.7., that must be generated by the fundamental dynamic I.1. and I.2. in order to form the basis of this creation framework is given by a high-order spinor $\Psi^{\textcircled{n}}(x,\sigma)$ – where n is odd – in the split-separated local neighbourhood (x,σ). Since ET 1 (structuring) requires an even number of base spinors, specifically 8, at least one elementary fermion $\Psi^{\textcircled{3}}$ must be created for ET 2 to be fulfilled, i.e. at least one elementary particle with an odd number of internal base spinors must be present.

This implies:

The primitive spinor material (see I.9.) that must be generated therefore contains the following components (with potentially others to come):

I.10.

⑧	+	**③** + **...**	≡	**⑪** + **... base spinors**
From the 1st elementary particle condition ≡ ET 1 , see I.7.		**From the 2nd elementary particle condition ≡ ET 2 , see I.7.**		**From elementary particle conditions 1 and 2 ≡ ET 1, ET 2, see I.7.**

Hence: The elementary particle creation process takes the simplest path possible , meaning that (see I.0.3.) this framework has the most economical structure that can be derived from

the fundamental dynamic I.1. :

$$D\,\Psi(x) \equiv \lim_{\sigma_1 \to 0} \Psi(x-\sigma_1)\ \overline{\Psi}(x)\ \Psi(x+\sigma_1) \quad \text{sowie} \quad \text{I.2.} \equiv D\,\overline{\Psi}(x) \equiv \lim_{\sigma_2 \to 0} \overline{\Psi}(x-\sigma_2)\ \Psi(x)\ \overline{\Psi}(x+\sigma_2)$$

or, in other words, the simplest non-linear structure possible.

The creation mechanism of this construction framework is based around the fact that every base spinor dynamically generated by the process I.1. and I.2. is then itself subject to the fundamental dynamic in turn, so long as the system remains open, i.e. so long as the point split $\sigma \neq 0$ is non-zero, while the point split limit value $\lim \sigma = 0$ is not attained.

The elementary particle creation process continues to act until the elementary particle creation conditions ET 1 and ET 2 (see I.7.) are fulfilled.

This produces the following elementary particle creation and construction framework, without yet discussing in detail the subsequent development of the various point splits (for more detail, see III.4.1.):

The elementary particle construction framework is built up by the fundamental dynamic I.1. and I.2. while the system remains open, corresponding to the 1st phase of the point-splitting process: point split $\sigma \neq 0,\ \sigma \rightarrow 0$, but point split not yet = 0, i.e. while the local neighbourhood x,σ, $\sigma \neq 0$ is still split-open. This framework develops – as will later be shown (see I.12.) – from the action of exactly 13 separate differential operations, all of which necessarily occur. Each individual differential operation has the same type as the fundamental dynamic I.1. and I.2. and each of them applies the fundamental dynamic to a corresponding base spinor Ψ or $\overline{\Psi}$ – locally separated by the constraints placed upon them by the point splits (so long as $\sigma \neq 0$).

Thirteen separate differential operations is the smallest number possible – coherent with I.0.3 – for the requirements ET 1, ET 2, (see I.7.) and by extension EK 1, EK 2, EK 3 to be fulfilled.

It follows that: D⑬ is constructed as follows in the split-open local neighbourhood x,σ_{13}, over the course of 3 phases (see diagram I.12.) :

I.11.

① differential operation $D^{(1)}$ ⟹ base tier Ψ③, <u>not</u> sufficient – violating ET 1 –
⟹ another ③ differential operations $D^{(2\text{-}4)}$ ⟹ 1st creation tier Ψ⑨, <u>not</u> sufficient – violating ET 2 –
⟹ another ⑨ differential operations $D^{(5\text{-}13)}$ ⟹ 2nd creation tier Ψ㉗, sufficient – satisfying ET 1 and ET 2 –
⟹ the creation process is complete.

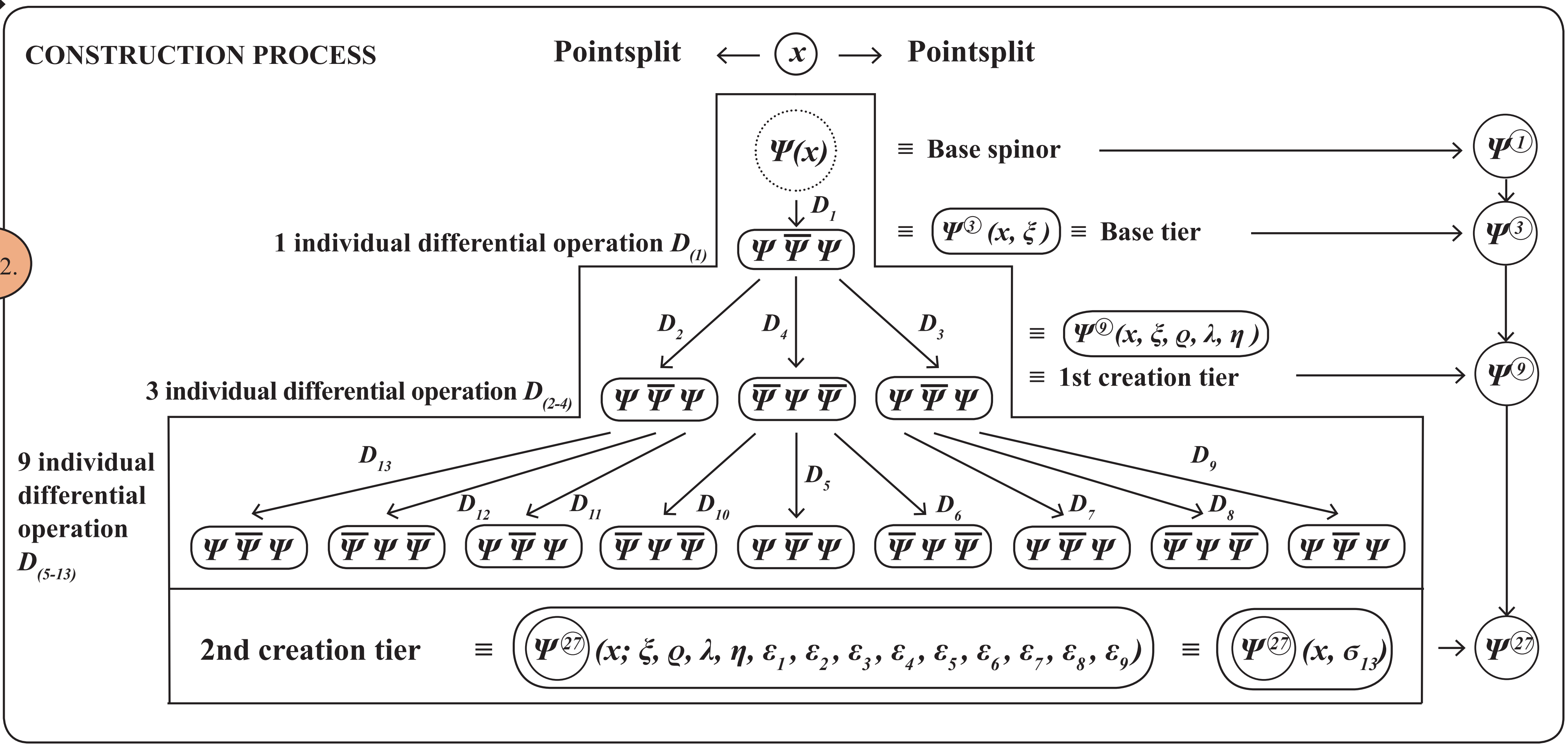
The elementary particle construction process is thus a sequence of exactly 13

⑬ differential operations $D^{1,\,2\text{-}4,\,5\text{-}13}$ ≡ D⑬ (x,σ_{13}) in the point split-open local neighbourhood x,σ_{13},

acting at characteristic, isolated points in space-time $x,\sigma_{(1+3+9)}$, each operation independently driven by the fundamental dynamic I.1. and I.2.. Each differential operation generates its own point split.

This produces the following elementary particle creation and construction framework, as a dynamically arising sequence of processes drawing from the fundamental dynamic I.1. and I.2. through ⑬ characteristic, independent differential operations:

I.12.



Since, in the system opening phase $\sigma_{13} \neq 0$ the spinor construction framework Ψ㉗ (x, σ_{13}) is localised within the split-separated neighbourhood (x, σ_{13}), the Pauli exclusion principle does not apply. The physical objects that will be created in the system closing phase $\sigma \rightarrow 0$ (which are p^+, e^-, ν, γ, Z, G) have at most 4 internal base spinors, a maximum which is specifically only attained by the graviton G, and hence satisfy the Pauli exclusion principle during the particle creation process. So, for example, the effective elementary fermions p^+, e^-, ν are all Ψ③-objects, and this explains how their creation can occur without violating the Pauli exclusion principle.

The dynamic creation mechanism that generates the raw spinor material groupings necessary for elementary particle creation – as described in I.9., I.10., I.12. – originates from the fact that the following statement already holds in the fundamental dynamic

$D\Psi \equiv \lim_{\xi \to 0} \Psi(x-\xi)\ \overline{\Psi}(x)\ \Psi(x+\xi)$ to the presence of the point split $\xi \neq 0$, i.e. $\xleftarrow{-\xi} x \xrightarrow{+\xi}$

in the first phase of the point-splitting process, during the system opening phase $\sigma \neq 0$, before the limit value $\lim \sigma = 0$ is attained in the closing phase of the point-splitting process:

The 3 spinors $\Psi^{\textcircled{3}}(x, \xi)$ present in the base tier, see I.12., form an open system, with $\xi \neq 0$ i.e. they have not yet been bound by the limiting process $\lim \xi = 0$.

These 3 individual spinors $\Psi^{\textcircled{3}}(x, \xi)$ – which are distinct but nonetheless remain open during the 1st phase of the point-splitting event $\xi \neq 0$ (meaning that they exist in a state of open interaction) – each develop independently so long as they are not bound by the limiting process $\lim \xi = 0$. They exist as independent base spinors of dimension $Dim\ -\frac{1}{2}$ at distinct points in space-time $x-\xi$, x, $x+\xi$, where $\xi \neq 0$, together with their respective system-intrinsic interaction potentials, appending themselves to the overall system first initiated by the fundamental dynamic I.1. and I.2. as illustrated structurally in I.12.. This construction occurs in the following fashion (see I.13.):

I.13.

$$\begin{tikzcd}
\Psi(x) \arrow[r] & \boxed{\Psi^{\textcircled{3}}(x\,,\pm\xi)} \arrow[r] \arrow[d, phantom, sloped, "\equiv"] & \boxed{\Psi^{\textcircled{9}}\,(x;\pm\xi,\pm\varrho,\pm\lambda,\pm\eta)} \arrow[r] \arrow[d, phantom, sloped, "\equiv"] & \boxed{\Psi^{\textcircled{27}}\,(x;\pm\xi,\pm\varrho,\pm\lambda,\pm\eta,\pm\varepsilon_1,\pm\varepsilon_2,\pm\varepsilon_3,\pm\varepsilon_4,\pm\varepsilon_5,\pm\varepsilon_6,\pm\varepsilon_7,\pm\varepsilon_8,\pm\varepsilon_9)} \arrow[d, phantom, sloped, "\equiv"] \\
 & \boxed{\Psi^{\textcircled{3}}(x,\sigma_1)} \arrow[d, phantom, sloped, "\equiv"] & \boxed{\Psi^{\textcircled{9}}(x,\sigma_4)} \arrow[d, phantom, sloped, "\equiv"] & \boxed{\Psi^{\textcircled{27}}\,(x,\sigma_{13})} \arrow[d, phantom, sloped, "\equiv"] \\
 & \boxed{\text{Base tier}} & \boxed{\text{1st creation tier}} & \boxed{\text{2nd creation tier}}
\end{tikzcd}$$

Hence: Initiated by the necessary existence of the point split (see I.1. and I.2.), i.e. from the fact that the existence of the differential operator $D \equiv \frac{d}{dx}$ automatically implies the existence of the point split (dx) ≡ (-ξ, +ξ), and brought to completion in the point split-opening phase $\xi \neq 0$, the elementary particle creation system as a whole is already set in motion by the fundamental dynamic I.1. and I.2., subject to the elementary criteria EK 1, EK 2, EK 3 (see I.0.1. to I.0.3.). In the point split-closure phase *lim* $\sigma = 0$, the coarse framework that was previously dynamically constructed is then refined to produce elementary particles (see chapters II. - IX.), and also endowed with all of the characteristic properties that make up each elementary particle: mass, charge, force interactions, force magnitudes, etc.

I.14.

The base tier $\Psi^{\textcircled{3}}(x, \xi)$ forms from the fundamental dynamic $D\,\Psi \equiv \Psi\,\overline{\Psi}\,\Psi$, see I.1.,

that is to say, by the process $\Psi(x) \xrightarrow{D} \Psi^{\textcircled{3}}(x, \pm\xi)$,

before the point split limit value $lim\ \xi = 0$ is attained,

So: $\Psi(x\text{-}\xi)\ \ \overline{\Psi}(x)\ \ \Psi(x+\xi) \equiv \Psi^{\textcircled{3}}(x, \pm\xi) \equiv$ base tier

I.15.

The 1st creation tier $\Psi^{\textcircled{9}}\ (x; \pm\xi, \pm\varrho, \pm\lambda, \pm\eta)$ is built upon the still split-open

base tier $\Psi^{\textcircled{3}}(x, \xi),\ \ \xi \neq 0$ by reapplying the same fundamental dynamic I.1. and I.2.

to each of the 3 split-separated – and hence open – base spinors $\Psi(x\text{-}\xi), \overline{\Psi}(x), \Psi(x+\xi)$,

This action persists until $\xi \neq 0$. This follow-up process causes the dynamic creation of the

1st creation tier $\Psi^{\textcircled{9}}(x\ ,\sigma_4)$ where $\sigma_4 = (\pm\xi, \pm\varrho, \pm\lambda, \pm\eta)$, see I.12..

I.16. **Since the 1st creation tier $\Psi^{\textcircled{9}}(x,\sigma_4)$ is a spinor product of 9 spinors in the split-separated local neighbourhood $x,\sigma_4 \neq 0$, it does not yet fulfil the elementary particle creation condition ET 2 (see I.7.). The 2nd creation state must therefore necessarily be constructed before the point split limit value *lim* $\xi, \varrho, \lambda, \eta = 0$ is attained, while the system is still in a dynamic split-open state $\Psi^{\textcircled{9}}(x,\sigma_4 \neq 0)$. This construction must occur according to exactly the same pattern as the process sequence that created the 1st creation tier $\Psi^{\textcircled{9}}(x,\sigma)$. The very same dynamic process that constructed the base tier $\overrightarrow{\text{to}}$ 1st creation tier, is then reapplied once again – that is to say:**

the fundamental dynamic I.1. and I.2. is applied to each of the ⑨ split-separated (and thus still open) spinors of $\Psi^{\textcircled{9}}(x,\sigma_4),\ \sigma_4 \neq 0$, so that through the action of

⑨ separate, fundamentally dynamic differential processes (see I.12.), the quantity of base spinors is tripled.

I.16.

The end-result of the complete creation process is therefore the spinor complex $\Psi^{㉗}(x,\sigma_{13})$ in the split-separated local neighbourhood x, σ_{13}, with

overall split-vector $\sigma_{13} = (x; \pm\xi, \pm\varrho, \pm\lambda, \pm\eta, \pm\varepsilon_1, \pm\varepsilon_2, \pm\varepsilon_3, \pm\varepsilon_4, \pm\varepsilon_5, \pm\varepsilon_6, \pm\varepsilon_7, \pm\varepsilon_8, \pm\varepsilon_9)$,

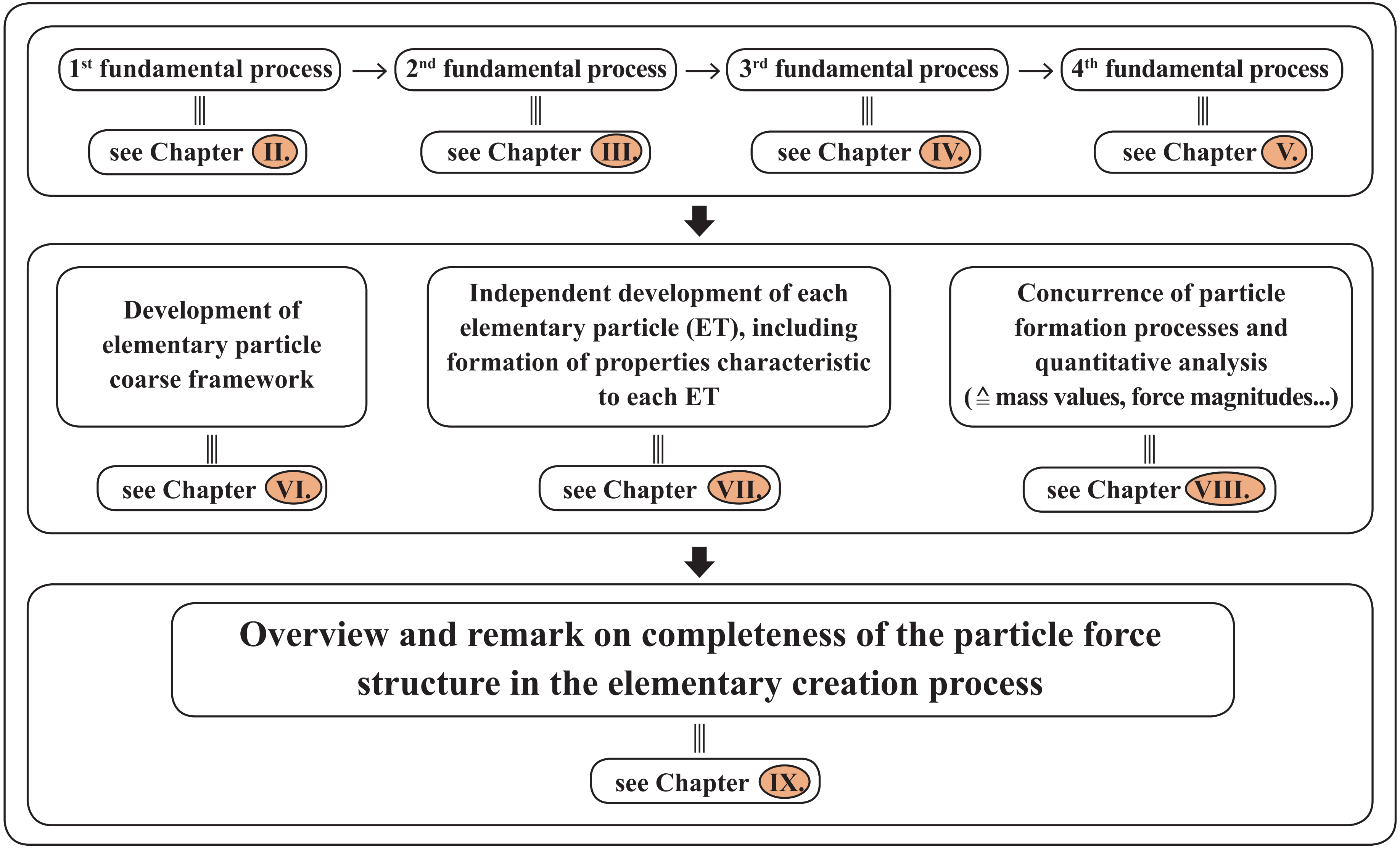
comprised of ⑬ different point split components. Each individual point split originates from one of the ⑬ individual, fundamentally dynamic differential operations , each of which is of type either

$$D\,\overline{\Psi}(x) \equiv \overline{\Psi}(x-\sigma_\nu)\;\; \Psi(x)\;\; \overline{\Psi}(x+\sigma_\nu) \quad \text{bzw.} \quad D\,\Psi(x) \equiv \Psi(x-\sigma_2)\;\; \overline{\Psi}(x)\;\; \Psi(x+\sigma_2)\,.$$

Since the whole of this creation process occurs in a neighbourhood x,σ_{13} that is still open and split-separated, i.e. while $\sigma_{13} \neq 0$, before the point split limit value $\sigma_{13} \equiv 0$ is attained, the Pauli exclusion principle does not apply.

Specifically, the whole elementary particle creation process occurs in the following successive stages:

I.17.



1st fundamental process → 2nd fundamental process → 3rd fundamental process → 4th fundamental process

see Chapter II. | see Chapter III. | see Chapter IV. | see Chapter V.

Development of elementary particle coarse framework

see Chapter VI.

Independent development of each elementary particle (ET), including formation of properties characteristic to each ET

see Chapter VII.

Concurrence of particle formation processes and quantitative analysis (≙ mass values, force magnitudes...)

see Chapter VIII.

Overview and remark on completeness of the particle force structure in the elementary creation process

see Chapter IX.

Chapter II. The 1st fundamental process:

The inherent development of the 1st creation tier $\Psi^{\textcircled{9}}(x,\sigma_4)$

The overall chain of processes begins with the 1st fundamental process, which constructs the 1st creation tier from the base tier and deploys the local point split layout through four successive, back-to-back differential operations. The order of the differential operations is fixed (see I.12.).

II.1.

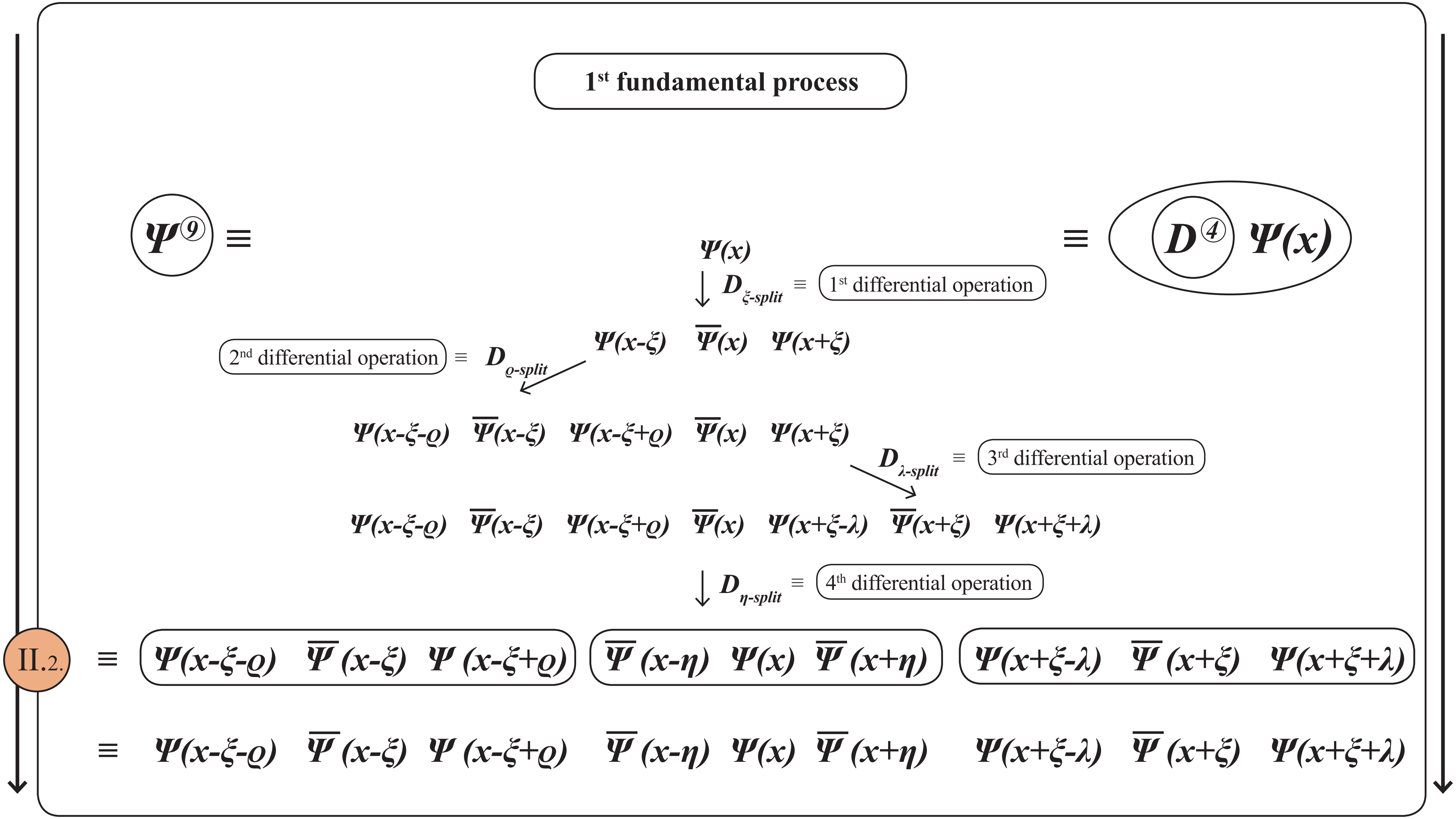
1st differential operation ⟹ ξ-split
2nd differential operation ⟹ ϱ-split
3rd differential operation ⟹ λ-split
4th differential operation ⟹ η-split

successive

The 1st creation tier $\Psi^{\textcircled{9}}(x,\sigma_4)$ (see I.12., I.13.) is built up by the sequence of operations shown II.1.

The specific details, together with a detailed discussion of the associated point split structure, is as follows:

➡



1st fundamental process

$$\Psi^{\textcircled{9}} \equiv \ldots \equiv D^{\textcircled{4}}\,\Psi(x)$$

$$\Psi(x)$$

$$\downarrow D_{\xi\text{-split}} \equiv \boxed{\text{1st differential operation}}$$

$$\Psi(x-\xi) \quad \overline{\Psi}(x) \quad \Psi(x+\xi)$$

$$\boxed{\text{2nd differential operation}} \equiv D_{\varrho\text{-split}} \swarrow$$

$$\Psi(x-\xi-\varrho) \quad \overline{\Psi}(x-\xi) \quad \Psi(x-\xi+\varrho) \quad \overline{\Psi}(x) \quad \Psi(x+\xi)$$

$$\searrow D_{\lambda\text{-split}} \equiv \boxed{\text{3rd differential operation}}$$

$$\Psi(x-\xi-\varrho) \quad \overline{\Psi}(x-\xi) \quad \Psi(x-\xi+\varrho) \quad \overline{\Psi}(x) \quad \Psi(x+\xi-\lambda) \quad \overline{\Psi}(x+\xi) \quad \Psi(x+\xi+\lambda)$$

$$\downarrow D_{\eta\text{-split}} \equiv \boxed{\text{4th differential operation}}$$

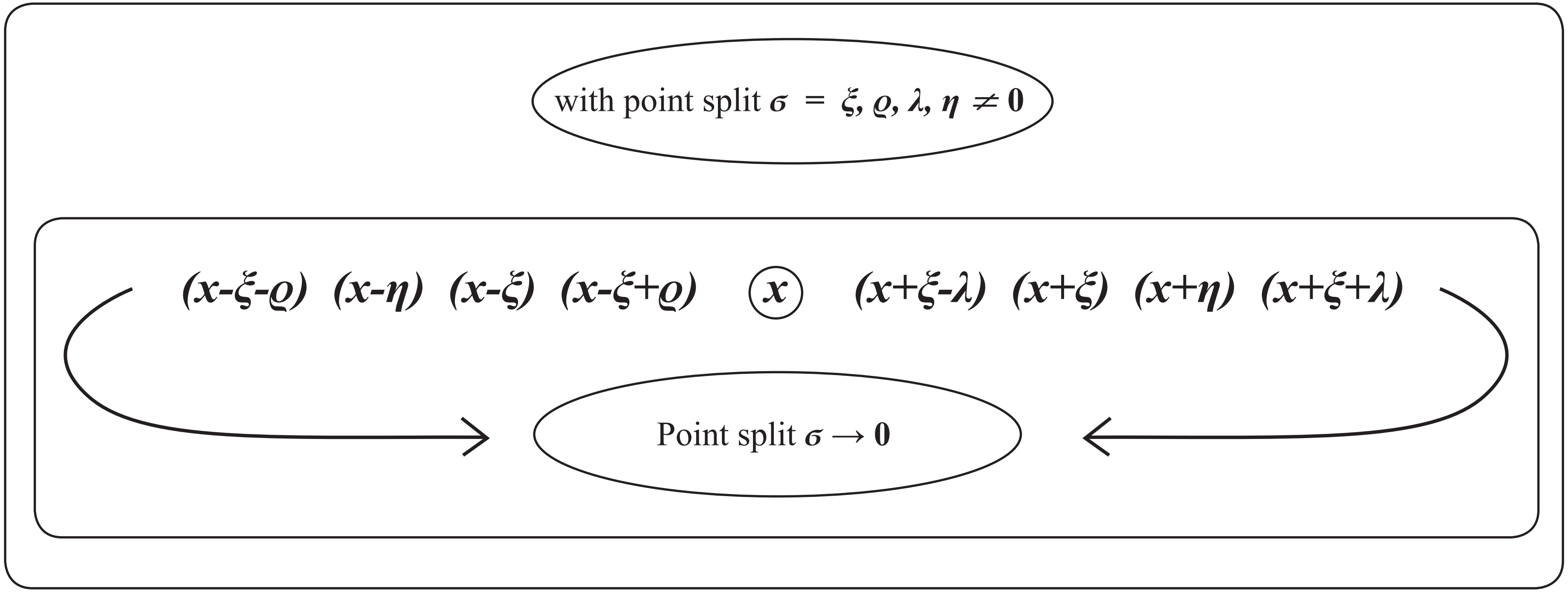
$$\equiv \boxed{\Psi(x-\xi-\varrho) \quad \overline{\Psi}(x-\xi) \quad \Psi(x-\xi+\varrho)} \; \boxed{\overline{\Psi}(x-\eta) \quad \Psi(x) \quad \overline{\Psi}(x+\eta)} \; \boxed{\Psi(x+\xi-\lambda) \quad \overline{\Psi}(x+\xi) \quad \Psi(x+\xi+\lambda)} \tag{II.2.}$$

$$\equiv \Psi(x-\xi-\varrho) \quad \overline{\Psi}(x-\xi) \quad \Psi(x-\xi+\varrho) \quad \overline{\Psi}(x-\eta) \quad \Psi(x) \quad \overline{\Psi}(x+\eta) \quad \Psi(x+\xi-\lambda) \quad \overline{\Psi}(x+\xi) \quad \Psi(x+\xi+\lambda)$$

All 4 point splits ($\xi, \varrho, \lambda, \eta$) are mutually independent.
The point splits are opened in the fixed order $\xi, \varrho, \lambda, \eta$, as shown in II.2. (as η is only triggered after ξ, see II.2.).

The effective relative gap of the point split $\sigma = \boxed{\xi, \varrho, \lambda, \eta} \neq 0$, $\sigma \to 0$ where σ is anchored to the local point x, and consequently the size of the point split neighbourhood x,σ is as follows, determined by the 4 back-to-back differential operations D④ (η occurs after ξ , as shown in II.2. , implying that $(x-\eta)$ is further away from the local origin of interaction x than $(x-\xi)$, and therefore naturally also further away than $(x-\xi+\varrho)$:

II.3.



Through II.3., the dynamic layout II.2. is established, so that the

local distances between spinors in the point split neighbourhood of the local origin x

are arranged in their effective local layout as shown below:

II.4.

$$\boxed{\Psi(x-\xi-\varrho)\ \ \overline{\Psi}(x-\eta)\ \ \overline{\Psi}(x-\xi)\ \ \Psi(x-\xi+\varrho)\quad \Psi(x)\quad \Psi(x+\xi-\lambda)\ \ \overline{\Psi}(x+\xi)\ \ \overline{\Psi}(x+\eta)\ \ \Psi(x+\xi+\lambda)}$$

or

$$\boxed{\boxed{\Psi(x-\xi-\varrho)\ \ \overline{\Psi}(x-\eta)\ \ \overline{\Psi}(x-\xi)\ \ \Psi(x-\xi+\varrho)}\quad \Psi(x)\quad \boxed{\Psi(x+\xi-\lambda)\ \ \overline{\Psi}(x+\xi)\ \ \overline{\Psi}(x+\eta)\ \ \Psi(x+\xi+\lambda)}}$$

In this way, the 1st fundamental process II.2. automatically constructs a solution

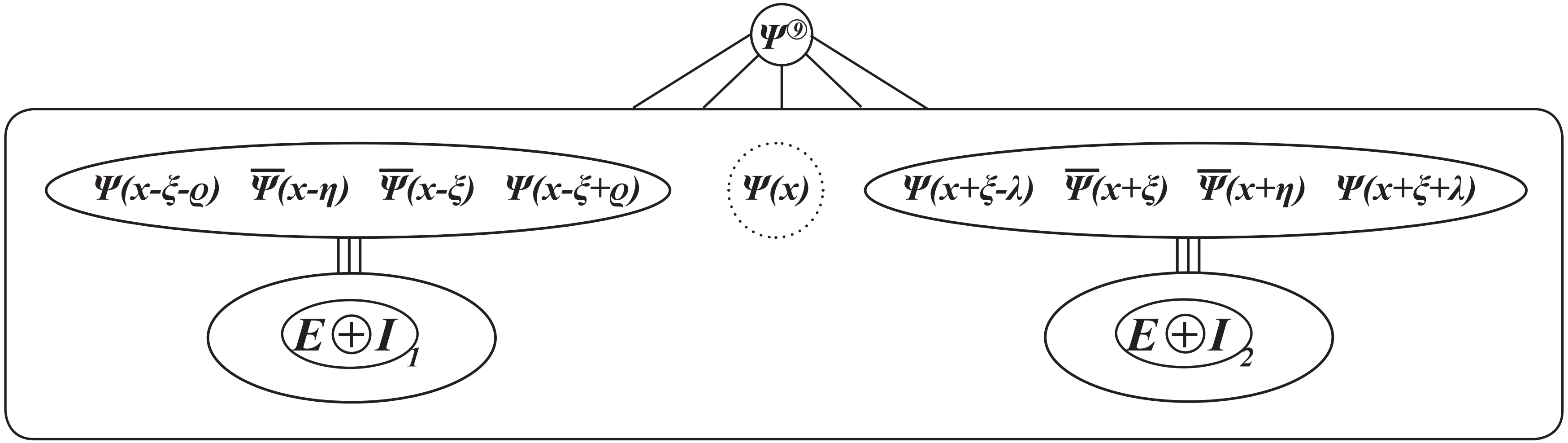
to condition I.4.: $$\begin{tikzcd} (E\oplus I)_1 \arrow[r, bend left] & (E\oplus I)_2 \arrow[l, bend left] \end{tikzcd}$$ **, dynamically generating the following:**

➡

II.5.

II.4. can be modelled as:

The 1st fundamental process in its local layout with the following structure:



Ψ⑨

$\Psi(x-\xi-\varrho)$ $\overline{\Psi}(x-\eta)$ $\overline{\Psi}(x-\xi)$ $\Psi(x-\xi+\varrho)$

$\Psi(x)$

$\Psi(x+\xi-\lambda)$ $\overline{\Psi}(x+\xi)$ $\overline{\Psi}(x+\eta)$ $\Psi(x+\xi+\lambda)$

$E \oplus I_1$

$E \oplus I_2$

where the two objects $E \oplus I_1$ and $E \oplus I_2$, have identical spinor structures.

During the limiting process $\boxed{\boxed{\xi, \varrho, \lambda, \eta} \to 0}$ the identity principle I.5. is then invoked,

with the following consequence:

The system must be extended. This same requirement also follows from the 2nd elementary particle creation condition (ET 2) (see I.7.)

Before the 2nd fundamental process is studied in Chapter III., the following side-remark shows precisely how structural quantization $\hbar$ arises as a consequence of the process inertia in the dynamic setup of the process sequence $\Psi^{\textcircled{9}}(x,\sigma_4)$ (see II.2.). Similarly, it will be shown how the space-time structure (x_1, x_2, x_3, t) arises from the four-parameter split $\sigma = (\xi, \varrho, \lambda, \eta)$ dargestellt wird.

Side-remark (II.5.1., II.5.2., II.6.):

Due to the $D^{\textcircled{4}}$-structure of the 1st fundamental process shown in II.2., necessary for the formation of $E \oplus I_1$ and $E \oplus I_2$ and unstoppable, but limited by its 4-parameter characteristic dynamic structure, structural quantization $(\hbar \neq 0)$ is caused around the local origin.

II.5.1.

Hence: quantization (where $\hbar$ is the structure constant arising by this process) is universal, as it is generated in the elementary creation process, when nothing other than the process itself exists.

Thus: Quantization $\hbar$ does not need to be assumed a priori, but is automatically generated by the 1st fundamental process.

As shown in II.5., it occurs “pairwise”.

This forced “paired” structure causes – as will be shown later –

by the action of the identity principle I.5., and esp. I.5.1.:

a dynamically forced extension to the system.

II.5.2.

During its setup II.2., Ψ⑨ acquires structure from D④ and the associated 4 fundamental, independent point splits $(\xi, \varrho, \lambda, \eta)$ at the origin of interaction x, corresponding to 4 independent “degrees of freedom”.

From this 4-parameter point split structure as reality progressively unfolds through the creation of elementary particles and fundamental forces the 4-dimensional externality structure x_1, x_2, x_3, x_4; where $x_4 = t$ (given the name of space-time)

is generated, so that the (initially abstract) origin of interaction x is structured into a 4-dimensional entity through the D④ dynamic of the 1st fundamental process and the associated 4 fundamental, necessarily occurring point splits.

Thus: from the 1st fundamental process II.2., which is unstoppable but limited by the characteristic 4-parameter dynamic structure *D*④, the following structure is created:

II.6.

①. Quantization; see II.2., II.5.

and

②. 4-dimensional space-time structure **see II.2.**

$$(\xi, \varrho, \lambda, \eta) \longrightarrow (x_1, x_2, x_3; t)$$

where the split-vector ξ, ϱ, λ is the initiating element for the spatial components x_1, x_2, x_3 and the point split η is the initiating element for the temporal component *t*, which together, by the progressive unfolding of reality through the creation of elementary particles and fundamental forces, are structured into the observable, familiar space-time framework.

End of side-remark

The details of the creation of space-time will be studied in a dedicated project.

So long as the limiting process $\sigma_4 = \xi, \varrho, \lambda, \eta \rightarrow 0$ is not yet complete, i.e. so long as $\sigma_4 = \xi, \varrho, \lambda, \eta \neq 0$ and the ⑨ separate base spinors comprising $\Psi^{\textcircled{9}}(x, \sigma_4)$ (see I.12.) in the open point split-neighbourhood x, σ_4, $\sigma_4 \neq 0$ are localised to points that are isolated in space-time (due to the point splits),

the exact same dynamic configuration that

led from the base tier $\Psi^{\textcircled{3}}(x, \xi)$ $\overset{\longrightarrow}{\text{to}}$ the 1st creation tier $\Psi^{\textcircled{9}}(x; \xi, \varrho, \lambda, \eta)$

via I.1. and I.2. once again enters into action.

This implies:

The fundamental dynamic I.1. und I.2. acts independently on each of the ⑨ point split-separated base spinors of the spinor complex $\Psi^{\textcircled{9}}(x, \sigma_4)$ and, by the action of ⑨ separate, independent differential operations $D^{5\text{-}13}_{(x, \sigma_9)}$ leads to a non-linear tripling of the spinor complex (siehe I.12.).

This signals the beginning of the 2nd fundamental process, where $D^{\textcircled{9}}$ represents 9 independent differential operations in the split-separated local neighbourhood x, σ_4 (see I.1., I.2., I.12.)

Chapter III. The 2nd fundamental process:

The inherent creation of the spinor complex $\Psi^{㉗}$ from the fundamental interaction I.1. and I.2.: $\Psi^{㉗} = D^{⑬}\,\Psi = D^{⑨}\,(D^{④}\Psi)$

The 2nd fundamental process occurs as follows (with 9 characteristic, independent differential operations $D^{ⓥ}$, where $v = 1, \dots 9$, and each D^{v} acts on the 1st creation tier $\Psi^{⑨}(x, \sigma_4)$ that was generated during the 1st fundamental process in the split-separated local neighbourhood x,σ_4. Thus, the 2nd fundamental process generates an additional 9 point splits $(\varepsilon_1, \dots, \varepsilon_9)$)

III.1.

$D^{⑨}\,\Psi^{⑨}(x, \sigma_4) \equiv \Psi^{㉗}(x, \sigma_{13})$ **where** $\sigma_{13} = (\xi, \varrho, \lambda, \eta, \varepsilon_1, \varepsilon_2, \varepsilon_3, \varepsilon_4, \varepsilon_5, \varepsilon_6, \varepsilon_7, \varepsilon_8, \varepsilon_9)$

or, taking into account $\Psi^{⑨} \equiv D^{④}\Psi(x)$, this means: in the split-open system – i.e. before the limit $\lim \sigma = 0$ is attained, the following holds:

III.2.

$$D^{⑨}_{\sigma_9}\,(\Psi^{⑨}(x, \sigma_4)) = D^{⑨}_{\sigma_9}\,(D^{④}_{\sigma_4}\,\Psi(x)) = D^{⑬}_{\sigma_{13}}\,\Psi(x) = \Psi^{㉗}(x, \sigma_{13})$$

which occurs while the process is split-open, i.e. while $\sigma \neq 0$:

III.3.

$$D^{⑬}_{\sigma_{13}}\,\Psi(x) \equiv \Psi^{㉗}(x, \sigma_{13}) \quad \textbf{where} \quad \lim \sigma_{13} = (\xi, \varrho, \lambda, \eta, \varepsilon_1, \varepsilon_2, \varepsilon_3, \varepsilon_4, \varepsilon_5, \varepsilon_6, \varepsilon_7, \varepsilon_8, \varepsilon_9) \longrightarrow 0$$

After III.3. , both of the underlying elementary particle creation criteria for the system as a whole ET 1 , ET 2 (see I.7.) are fulfilled, and so I.10. is also fulfilled.

This marks the end of the creation of raw spinor material , i.e. the spinor complex $\Psi^{⑰}(x, \sigma_{13})$ generated strictly from the fundamental dynamic I.1. and I.2. in the split-separated local neighbourhood x, σ_{13} fulfils, as a $\Psi^{⑰}$ -product , the elementary particle creation conditions ET 1 and ET 2 . The development of the fundamentally dynamic, necessarily occurring elementary particle creation framework is now complete.

All physically existing elementary particles must form entirely and definitively from this framework.

It will be shown over the next chapters (chapters III. - IX.) that this is indeed the case.

But first, the $\Psi^{⑰}(x, \sigma_{13})$ -complex will be presented more closely (including a detailed discussion of its point split structure):

During the 2nd fundamental process, a dynamic spinor complex comprised of ㉗ spinors is generated in the neighbourhood of the local origin ⓧ from 13 independent point splits

$$\sigma_{(13)} \equiv \xi, \eta, \varrho, \lambda, \varepsilon_{1,} \varepsilon_{2,} \varepsilon_{3,} \varepsilon_{4,} \varepsilon_{5,} \varepsilon_{6,} \varepsilon_{7,} \varepsilon_{8,} \varepsilon_{9,}$$

III.4

$$\Psi^{\textcircled{27}}$$

$$\equiv$$

$$\Psi(x-\xi+\varrho-\varepsilon_6)\ \overline{\Psi}(x-\xi+\varrho)\ \Psi(x-\xi+\varrho+\varepsilon_6)\ \Psi(x-\varepsilon_1)\ \overline{\Psi}(x)\ \Psi(x+\varepsilon_1)\ \Psi(x+\xi-\lambda-\varepsilon_2)\ \overline{\Psi}(x+\xi-\lambda)\ \Psi(x+\xi-\lambda+\varepsilon_2)$$

$$\Psi(x-\xi-\varrho-\varepsilon_9)\ \overline{\Psi}(x-\xi-\varrho)\ \Psi(x-\xi-\varrho+\varepsilon_9)\ \overline{\Psi}(x-\eta-\varepsilon_8)\ \Psi(x-\eta)\ \overline{\Psi}(x-\eta+\varepsilon_8)\ \overline{\Psi}(x-\xi-\varepsilon_7)\ \Psi(x-\xi)\ \overline{\Psi}(x-\xi+\varepsilon_7)$$

$$\overline{\Psi}(x+\xi-\varepsilon_3)\ \Psi(x+\xi)\ \overline{\Psi}(x+\xi+\varepsilon_3)\ \overline{\Psi}(x+\eta-\varepsilon_4)\ \Psi(x+\eta)\ \overline{\Psi}(x+\eta+\varepsilon_4)\ \Psi(x+\xi+\lambda-\varepsilon_5)\ \overline{\Psi}(x+\xi+\lambda)\ \Psi(x+\xi+\lambda+\varepsilon_5)$$

$$\equiv$$

$$\boxed{\Psi^{\textcircled{13}}\quad \overline{\Psi}(x)\quad \Psi^{\textcircled{13}}}$$

As an alternative to the representation used in III.4. in the interest of clarity it may be helpful to use the box-diagrams shown below to represent the Ψ㉗

Example: $\Psi(x - \xi - \varrho - \varepsilon_9)$ can be represented as

Ψ ← spinor

x ← origin of interaction

$-\xi -\varrho$ ← point split from the 1st fundamental process

$-\varepsilon_9$ ← point split from the 2nd fundamental process

A complete representation of the 2nd creation tier Ψ㉗(x, σ_{13}) in the split-open local neighbourhood x, σ_{13} is as follows:

III.4.1.

Ψ㉗

Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ	Ψ	$\overline{\Psi}$	Ψ	Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
$-\xi -\varrho$	$-\xi -\varrho$	$-\xi -\varrho$	$-\eta$	$-\eta$	$-\eta$	$-\xi$	$-\xi$	$-\xi$	$-\xi +\varrho$	$-\xi +\varrho$	$-\xi +\varrho$	0	0	0	$+\xi -\lambda$	$+\xi -\lambda$	$+\xi -\lambda$	$+\xi$	$+\xi$	$+\xi$	$+\eta$	$+\eta$	$+\eta$	$+\xi +\lambda$	$+\xi +\lambda$	$+\xi +\lambda$
$-\varepsilon_9$	0	$+\varepsilon_9$	$-\varepsilon_8$	0	$+\varepsilon_8$	$-\varepsilon_7$	0	$+\varepsilon_7$	$-\varepsilon_6$	0	$+\varepsilon_6$	$-\varepsilon_1$	0	$+\varepsilon_1$	$-\varepsilon_2$	0	$+\varepsilon_2$	$-\varepsilon_3$	0	$+\varepsilon_3$	$-\varepsilon_4$	0	$+\varepsilon_4$	$-\varepsilon_5$	0	$+\varepsilon_5$

$$\equiv$$

Ψ⑬ $\overline{\Psi}(x)$ Ψ⑬

The spinor complex Ψ㉗ contains 3 categories of spinors, carried over from the 1st and 2nd fundamental processes :

III.5.

I 8 base spinors from the 1st fundamental process
(spinors which do not involve any ε-split)

II 18 base spinors from the 2nd fundamental process, each involving an ε-split,

III and of course the *Ψ(x)*-spinor, which was carried through both fundamental processes without splitting.

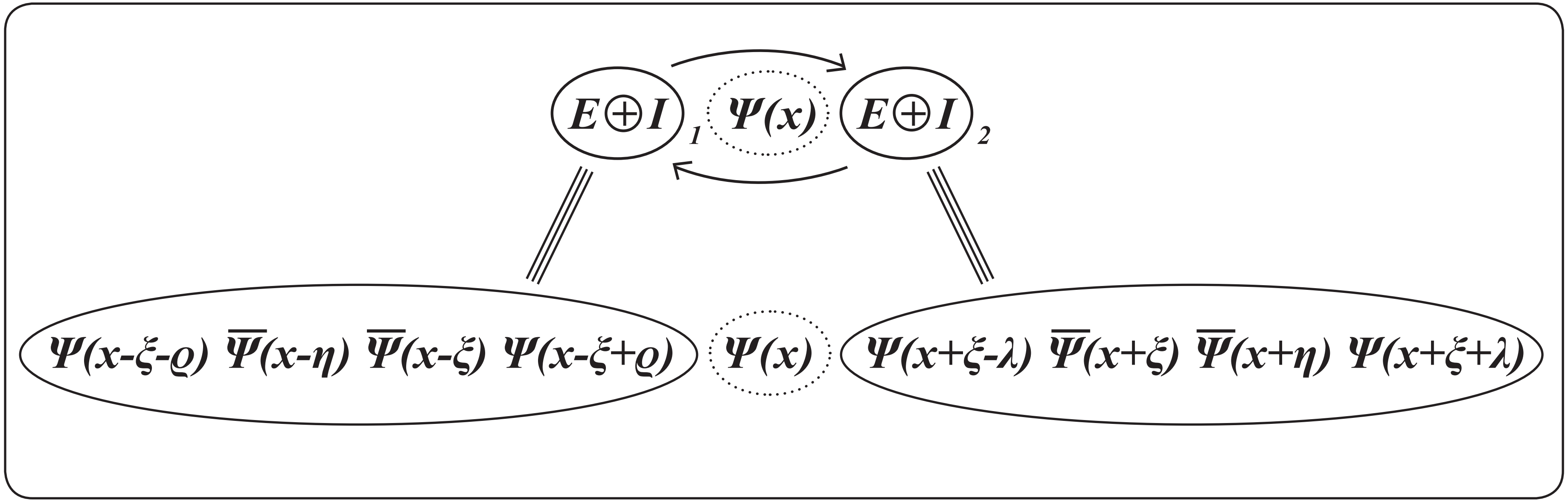
≡ II + III = ⑱ + ① ≡ ⑲ base spinors

III.5.1.

This means: I + II + III ≡ ㉗ base spinors in the split-separated local neighbourhood

In Chapter II., it was described how the two, mutually determining energy$\oplus$momentum formations $E\oplus I_1$ and $E\oplus I_2$ arise in the 1st fundamental process. When the corresponding local distance layout II.5. is taken into consideration, they are structured like this:

III.6.



This invokes once again the identity principle I.5. and esp. I.5.1. (due to the two structurally identical entities $\Psi\overline{\Psi}\overline{\Psi}\Psi$ and $\Psi\overline{\Psi}\overline{\Psi}\Psi$ in III.6.), which acts by triggering a restructuring process that generates new relationships between the component parts:

This means: the two mutually determining, fundamentally identical energy⊕momentum-objects

$$\begin{tikzcd} (E\oplus I)_1 \arrow[r, bend left] & (E\oplus I)_2 \arrow[l, bend left] \end{tikzcd}$$

restructured into their new, mutual relationship by the action of the identity principle I.5. (≡ prohibition of two identical objects, from I.5.2.):
this proceeds according to the **Minimality Principle I.0.3.**, the necessary, governing principle of the elementary creation phase, and the only such principle available.
Hence, the process proceeds by the strictest, and simultaneously simplest path possible.
Consequently:

The action of the identity principle I.5.2. in III.4 leads to a structuring of the original 8 spinors generated during the 1st fundamental process II.2., by classifying them into Ψ-spinors and $\overline{\Psi}$-spinors. This classification is not only structurally fundamental – because of the identity principle I.5. – , but is dynamically forced by the point split, since in III.6. :

III.6.1.

the 4 Ψ-spinors, namely $\Psi(x-\xi)\ \Psi(x-\eta)\ \Psi(x+\xi)\ \Psi(x+\eta)$, were the first to split from the origin of interaction x, i.e. ξ and η are primary splits, as shown in II.2.

and

the 4 $\overline{\Psi}$-spinors anchored at the interaction points $x \pm \xi$, namely $\overline{\Psi}(x-\xi-\varrho)\ \overline{\Psi}(x-\xi+\varrho)\ \overline{\Psi}(x+\xi-\lambda)\ \overline{\Psi}(x+\xi+\lambda)$,) – points that already originate from primary splits – are secondary split spinors, corresponding to the splits ϱ , λ. In other words, ϱ and λ are secondary splits, as shown in III.6.

➡

Hence, within the primitive spinor framework III.4. ≡ $\Psi^{㉗}(x, \sigma_{13})$ in the 2nd fundamental process, the following 8 base spinors can be identified as originating from the 1st fundamental process II.2.:

$$\text{8 base spinors} \equiv \Psi(x-\xi-\varrho)\ \ \overline{\Psi}(x-\eta)\ \ \overline{\Psi}(x-\xi)\ \ \Psi(x-\xi+\varrho)\qquad \Psi(x+\xi-\lambda)\ \ \overline{\Psi}(x+\xi)\ \ \overline{\Psi}(x+\eta)\ \ \Psi(x+\xi+\lambda),$$

which are now physically organised into the form

$$\begin{tikzcd} (E\oplus I)_1 \arrow[r, bend left] & (E\oplus I)_2 \arrow[l, bend left] \end{tikzcd}$$

(see II.5.).

This act of physical identification, performed on the dynamically generated system of primitive material III.4. , prompts a reorganisation within the two identical structures $\Psi\overline{\Psi}\overline{\Psi}\Psi$ $\Psi\overline{\Psi}\overline{\Psi}\Psi$ by the action of the identity principle I.5. (and esp. I.5.2.)

III.6.2.

This reorganisation allows for the formation – by I.6. – of the system-critical structuring agents :

separation-momentum, separation-energy , binding-momentum, binding-energy.

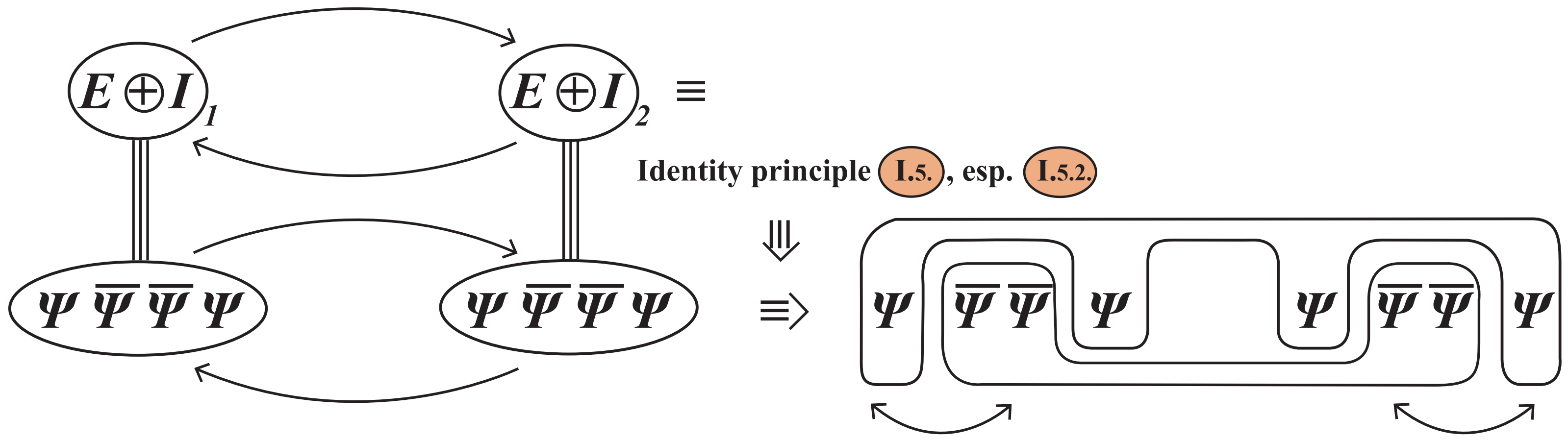
This structuring framework then prompts the structuring of the dynamically generated primitive material $\Psi^{㉗}(x, \sigma_{13})$ „from within itself“, the process is initiated internally, without any external trigger. This structuring is therefore a fundamental, system-intrinsic mechanism. This intrinsic structuring of the raw material $\Psi^{㉗}$ provides a coarse framework from which the elementary particles will later form. .

This all occurs while the point split is open $\sigma \neq 0$, $\sigma \rightarrow 0$, , during the system opening phase. The act of point splitting progressively unfolds the system that was first brought into existence by the fundamental dynamic I.1. and I.2. – see I.12. – , building it up step-by-step over the course of a multistage elementary particle creation process.

This fundamental creation process proceeds until all measurable and identifiable, physical objects have been formed. Nothing more, and nothing less.

This development-critical structuring mechanism, released by the identity principle I.5., esp. I.5.2., occurs as follows:

III.7.



Thus, during the limiting process $\sigma \to 0$, within the two mutually determining objects (as in I.4.)

$$\begin{tikzcd} (E\oplus I)_1 \arrow[r, bend left] & (E\oplus I)_2 \arrow[l, bend left] \end{tikzcd}$$

there occurs:

⤋

a characteristic reorganisation of the base spinors, forced by the identity principle I.5.. This reorganisation occurs by organising the 8 base spinors originating from the 1st fundamental process into the configuration described below. Note that this configuration fulfils the elementary particle creation criteria ① + ② simultaneously, and in particular I.7., I.8. and I.8.1. .

Thus: In III.4., there occurs $\boxed{\text{a forced reorganisation into: } \boxed{\overbrace{\Psi \ldots \Psi \ldots \Psi \ldots \Psi} \text{ and } \overbrace{\overline{\Psi} \ldots \overline{\Psi} \ldots \overline{\Psi} \ldots \overline{\Psi}}}}$,

III.8.

or, factoring in the point split structure from III.4. and III.4.1. :

$$\boxed{\overbrace{\Psi(x-\xi) \ldots \Psi(x-\eta) \ldots \Psi(x+\xi) \ldots \Psi(x+\eta)}} \text{ and } \boxed{\overbrace{\overline{\Psi}(x-\xi-\varrho) \ldots \overline{\Psi}(x-\xi+\varrho) \ldots \overline{\Psi}(x+\xi-\lambda) \ldots \overline{\Psi}(x+\xi+\lambda)}}$$

This new configuration satisfies the strict Minimality Principle for elementary particle creation (see I.0.3.), and occurs without loss or addition to any of the 8 base spinors from the 1st fundamental process III.5. .

Consequently for the $\boxed{\text{spinor complex } \Psi^{\textcircled{27}}} \equiv \boxed{D^{\textcircled{9}}\, \Psi^{\textcircled{9}}} = \boxed{D^{\textcircled{9}}\, D^{\textcircled{4}}\, \Psi}$ **:**

The dynamically generated overall system $\Psi^{\textcircled{27}}$ is preserved, but undergoes an internal restructuring process effected by the identity principle I.5., esp. I.5.2. , triggering the 3rd fundamental process :

Chapter IV. The 3rd fundamental process:
The inherent creation of structuring energy and momentum (separation and binding)

Through the point splitting process:

First point split $\sigma \neq 0$: $\leftarrow x \rightarrow$ **(separation)**

Then point split $\sigma \rightarrow 0$: $\rightarrow x \leftarrow$ **(binding)**

the structuring mechanism inherently present in the system is released as described in III.7. :

IV.1. **The splits ξ and η (but none of the others) are anchored directly to the origin of interaction x – as shown in III.6.1. – and are therefore primary splits.**

Through this primary separation process, the 4 spinors in the $\Psi^{㉗}(x, \sigma_{13})$ -system, directly bound together by the splits $-\xi, -\eta, +\xi, +\eta$ (see III.4. esp. III.4.1.), namely:

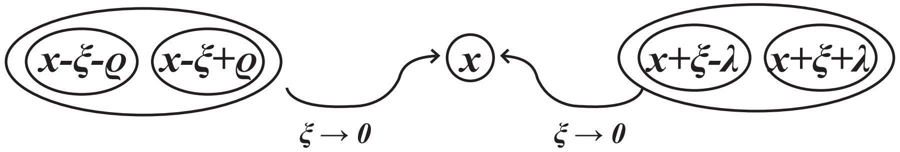
IV.2. **$\Psi(x-\xi)$ … $\Psi(x-\eta)$ … $\Psi(x+\xi)$ … $\Psi(x+\eta)$ form the separation-energy ⊕ momentum necessary (by I.8.1.) to endow the spinor complex $\Psi^{㉗}(x, \sigma_{13})$ with structure in the form of 4 separating elements …≀ …≀…≀ …≀ …**

Analogously for the binding structure:

The spinors from $\Psi^{㉗} \equiv$ III.4 anchored to the local points $(x\text{-}\xi\text{-}\varrho), (x\text{-}\xi\text{+}\varrho), (x\text{+}\xi\text{-}\lambda), (x\text{+}\xi\text{+}\lambda)$, – also without an ε-split – have a binding effect, as their ϱ, λ splits are not directly anchored to the origin of interaction x (they are not primary splits), but instead are anchored to the already ξ-split space-time points $(x \pm \xi)$) – they are secondary splits.

As a consequence, through the dynamic point splitting process, the first point split $\sigma \neq 0$ (in this case $\xi \neq 0$), followed by the point split $\sigma \to 0$ (in this case $\xi \to 0$) with $\xi \to 0$ act together like a binding structure.

IV.3.



IV.4.

Thus: There exists the binding- energy ⊕ momentum:

$$(E\oplus I)_{Binding} = (\overline{\Psi}(x\text{-}\xi\text{-}\varrho)\ \dots\ \overline{\Psi}(x\text{-}\xi\text{+}\varrho)\ \dots\ \overline{\Psi}(x\text{+}\xi\text{-}\lambda)\ \dots\ \overline{\Psi}\ (x\text{+}\xi\text{+}\lambda))$$

The above describes how the mechanism unfolds: “first, point split $\sigma \neq 0$“ and „then, pointsplit $\sigma \to 0$“.

This creates the structuring agents crucial to the rest of the process: separation and binding (see III.6.2.).

As a result: $\begin{tikzcd}(E\oplus I)_1 \arrow[r, bend left] & (E\oplus I)_2 \arrow[l, bend left]\end{tikzcd}$ **is formed anew from II.4., by the 1st and 2nd fundamental processes:**

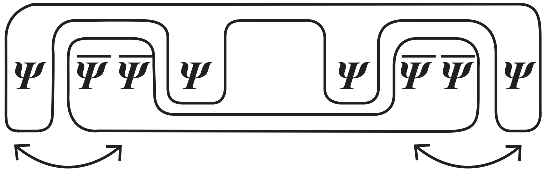
into structuring separation- energy⊕momentum ≡ $(E \oplus I)_{Separation}$

and structuring binding- energy⊕momentum ≡ $(E \oplus I)_{Binding}$

Thus: as a consequence of the identity principle I.5., and esp. I.5.2. it holds that:

IV.5.

$$\begin{tikzcd}(E \oplus I)_1 \arrow[r, bend left] & (E \oplus I)_2 \arrow[l, bend left]\end{tikzcd} \Rrightarrow$$



(see III.7.)

So: in the 3rd fundamental process, the separation and binding energy⊕momentum become active, and in doing so are consumed by their respective structuring actions, generating the subsequently active separation and binding elements „∪“ and „⌇“ inside the $\Psi^{⑲}$-spinor complex.

IV.6.

$$\Psi^{㉗} \xrightarrow{(E \oplus I)_{Trenn} \uparrow (E \oplus I)_{Binde}} \Psi^{⑲}_{⌇\cup}$$

In this way, the $\Psi^{⑲}$-spinor complex forms, with structure ready for particle creation provided by the structural elements ⌇ ≡ separation and ∪ ≡ binding, in the following, deterministic fashion, described in detail below:

IV.7. **The individual spinors that make up the $(E \oplus I)_{Separation}$ become structurally active, and are consumed by their structuring action, forming - within $(\Psi$㉗$)$ - into the internally-acting separation-(energy ⊕ momentum), $(E \oplus I)_{Separation}$. Wherever the $(E \oplus I)_{Separation}$-spinors are active,**

the structural separation component ≀ is created.

An analogous process occurs for the **binding-(energy ⊕ momentum)** $\equiv (E \oplus I)_{Binding}$, which is as follows:

IV.8. **The individual spinors that make up the $(E \oplus I)_{Binding}$ become structurally active, and are consumed by their structuring action, forming into the internally-acting binding-(energy ⊕ momentum) $(E \oplus I)_{Binding}$, and subsequently consumed by this binding action.**

Wherever the $(E \oplus I)_{Binding}$-spinors are active,

structural binding component ∪ is created.

This leads to the 4th fundamental process:

Chapter V. **The 4th fundamental process:**

The inherent creation of the structured spinor complex $\Psi^{⑲}_{\wr\cup}$.

By the 1st, 2nd and 3rd fundamental processes, and from the action of IV.2. by IV.7. and IV.4. by IV.8. the structured $\Psi^{⑲}$ -complex is created from $\Psi^{㉗}$ together with dynamically generated point split groupings:

$$\Psi^{㉗} \xrightarrow{(E\oplus I)_{Separation} \;\uparrow\; (E\oplus I)_{Binding}} \Psi^{⑲}_{\wr\cup}$$

in the following configuration:

V.1.

The structured $\Psi^{⑲}_{\wr\cup}$:

$$\underbrace{\underbrace{\Psi(x-\xi-\varrho-\varepsilon_9)\;\Psi(x-\xi-\varrho+\varepsilon_9)}_{}\;\overline{\Psi}(x-\eta-\varepsilon_8)}_{F_1}\;\wr\;\underbrace{\overline{\Psi}(x-\eta+\varepsilon_8)\;\overline{\Psi}(x-\xi-\varepsilon_7)\;\wr\;\Psi^{⑨}(x,\xi,\varepsilon_7,\varrho,\varepsilon_6,\varepsilon_1,\varepsilon_2,\varepsilon_3)\;\wr\;\overline{\Psi}(x+\xi+\varepsilon_3)\;\overline{\Psi}(x+\eta-\varepsilon_4)}_{G}\;\wr\;\underbrace{\overline{\Psi}(x+\eta+\varepsilon_4)\;\underbrace{\Psi(x+\xi+\lambda-\varepsilon_5)\;\Psi(x+\xi+\lambda+\varepsilon_5)}_{}}_{F_2}$$

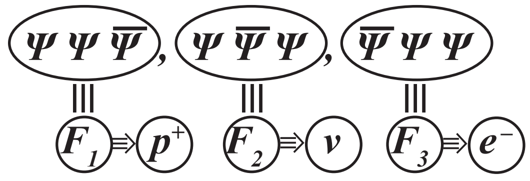
V.2. **where**

$$\Psi^{⑨} \equiv \left[\overline{\Psi}(x-\xi+\varepsilon_7)\;\underbrace{\Psi(x-\xi+\varrho-\varepsilon_6)\;\Psi(x-\xi+\varrho+\varepsilon_6)}_{}\;\left(\Psi(x-\varepsilon_1)\;\overline{\Psi}(x)\;\Psi(x+\varepsilon_1)\right)\;\underbrace{\Psi(x+\xi-\lambda-\varepsilon_2)\;\Psi(x+\xi-\lambda+\varepsilon_2)}_{}\;\overline{\Psi}(x+\xi-\varepsilon_3)\right] \equiv \Psi^{⑨}$$

Thus: with (V.1.), (V.2.) the elementary process is completely and definitively determined.

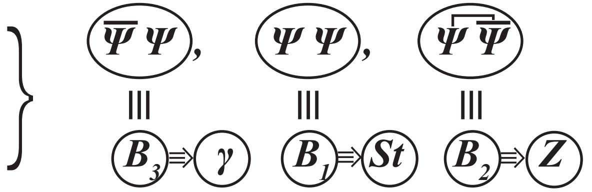
The elementary players (≡ elementary particles) will be presented in the later chapters (VI.) and (VII.) in detail, but can already be roughly predicted here from the groupings shown in (V.1.), (V.2.)

3 fermions (matter particles): **proton p^+, electron e^-, neutrino v** ≡



3 bosons (force-carriers):

γ ≡ electromagnetic interaction
St ≡ strong interaction
$Z(W^\pm)$ ≡ weak interaction ≡



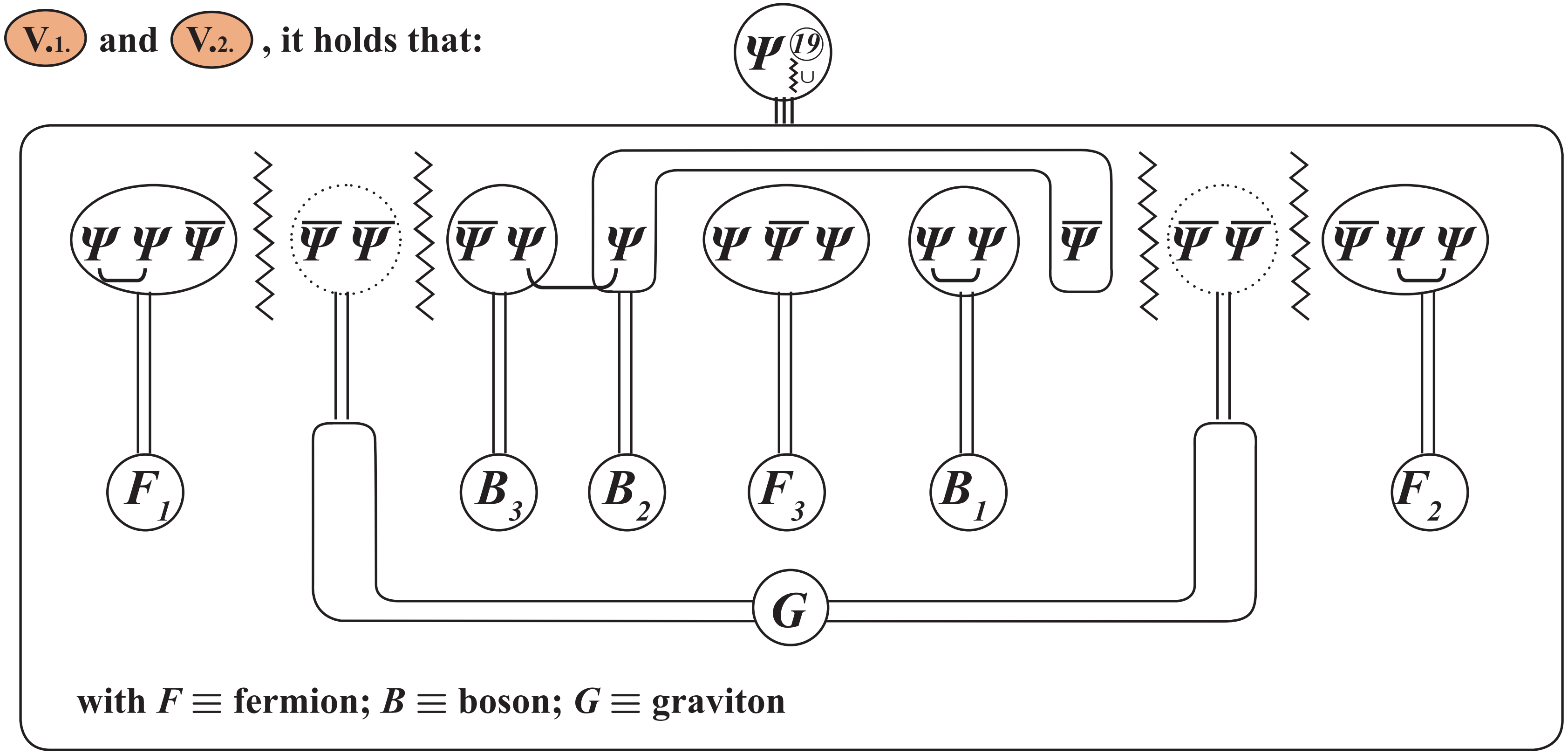
1 graviton (system closing force) **G ≡ gravitational interaction** ≡

Once the inherent creation of these (elementary matter and force particles) is complete, the structured spinor complex (Ψ⑲) generated by the fundamental interaction (I.1.) and (I.2.) is completely consumed. There are no other (elementary particles). Reality has been created (a later remark discusses completion).

Chapter VI. The construction of elementary particles: The creation of elementary particles from the inherently generated and inherently structured spinor complex (Ψ⑲)

➡ **From V.1. and V.2., it holds that:**

VI.1



with $F \equiv$ fermion; $B \equiv$ boson; $G \equiv$ graviton

with the point split densities listed below – dynamically generated, as in III.4.. A circled split indicates that it is intrinsic to that particle, i.e. only occurs in its ±-form in that particle. Thus (see V.1. and VI.1.), before the process of individualised elementary particle creation begins, the point splits are structurally distributed as follows over the individual components:

VI.2.

$$F_1 = F_1(-\xi, -\varrho, -\varepsilon_8, \enclose{circle}{\varepsilon_9}; -\eta) \qquad B_1 = B_1(+\xi, -\lambda; \enclose{circle}{\varepsilon_2})$$

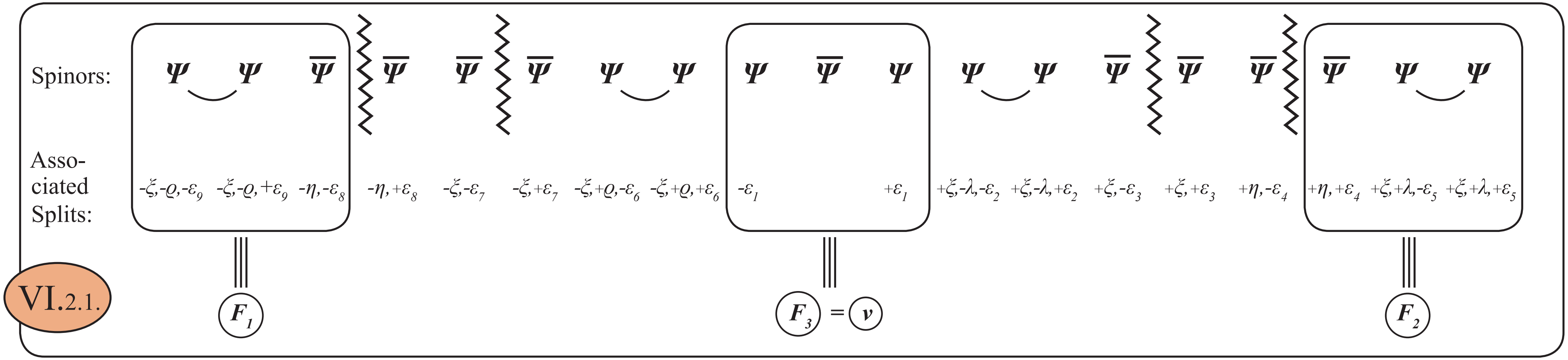
$$F_2 = F_2(+\xi, +\lambda, +\varepsilon_4, \enclose{circle}{\varepsilon_5}; +\eta) \qquad B_2 = B_2(-\xi, +\varrho, +\varepsilon_{6,} -\varepsilon_3)$$

$$F_3 = F_3(\enclose{circle}{\varepsilon_1}) = \text{1-split-fermion} \qquad B_3 = B_3(-\xi, +\varepsilon_7, +\varrho, -\varepsilon_6), \quad \text{where } G = G(\pm\xi, \pm\eta, +\varepsilon_3, -\varepsilon_4, -\varepsilon_7, +\varepsilon_8)$$

A circled $\enclose{circle}{\varepsilon_\nu}$ indicates that both the corresponding $\enclose{roundedbox}{+\varepsilon_\nu\text{-split}}$ and the corresponding $\enclose{roundedbox}{-\varepsilon_\nu\text{-split}}$ are present within the corresponding physical entity $\enclose{circle}{F_1}, \enclose{circle}{F_2}, \enclose{circle}{F_3}$ or $\enclose{circle}{B_1}, \enclose{circle}{\enclose{circle}{B_2}\enclose{circle}{B_3}}$ as a $\enclose{roundedbox}{\pm\text{-split object}}$.

The following representation might be more transparent:

VI.2.1.



Spinors:	Ψ	Ψ	$\overline{\Psi}$	$\overline{\Psi}$	$\overline{\Psi}$	$\overline{\Psi}$	Ψ	Ψ	Ψ	$\overline{\Psi}$	Ψ	Ψ	Ψ	$\overline{\Psi}$	$\overline{\Psi}$	$\overline{\Psi}$	$\overline{\Psi}$	Ψ	Ψ
Associated Splits:	$-\xi,-\varrho,-\varepsilon_9$	$-\xi,-\varrho,+\varepsilon_9$	$-\eta,-\varepsilon_8$	$-\eta,+\varepsilon_8$	$-\xi,-\varepsilon_7$	$-\xi,+\varepsilon_7$	$-\xi,+\varrho,-\varepsilon_6$	$-\xi,+\varrho,+\varepsilon_6$	$-\varepsilon_1$		$+\varepsilon_1$	$+\xi,-\lambda,-\varepsilon_2$	$+\xi,-\lambda,+\varepsilon_2$	$+\xi,-\varepsilon_3$	$+\xi,+\varepsilon_3$	$+\eta,-\varepsilon_4$	$+\eta,+\varepsilon_4$	$+\xi,+\lambda,-\varepsilon_5$	$+\xi,+\lambda,+\varepsilon_5$

where $\enclose{circle}{F_1}, \enclose{circle}{F_2}, \enclose{circle}{F_3}$ are elementary fermions: $\enclose{circle}{F_3}$ as the massless $\enclose{circle}{\text{1-split}}$-fermion $\enclose{circle}{\nu}$ from VI.3.1., $\enclose{circle}{F_1}$ as a candidate for $\enclose{circle}{p^+}$ and (subsequently) $\enclose{circle}{F_2}$ as a candidate for $\enclose{circle}{e^-}$ from VI.3.3. based on the presence of the $\enclose{circle}{\overline{\Psi}\,\underset{\smile}{\Psi\,\Psi}}$-sequence.

Before the individual particle formation processes are analysed, the next section studies the structural properties of the point split densities at the local origin $x\,(x \pm \sigma, \sigma \rightarrow 0)$:

VI.3.

Point split densities:

VI.3.1.

• 0 or 1-split-particles ≡ massless particles :

0 or 1 split do not influence space-time structure during particle creation – as is immediately obvious:

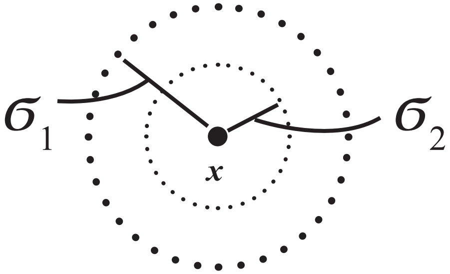
Thus: the spinor groupings within $\Psi^{ⓝ}$ with exactly 1 split have unobstructed access to the local origin x as $\sigma \rightarrow 0$ (i.e. during particle creation)

Thus: Particles with split density 0 or 1 are massless, and hence also chargeless, as they do not influence the structure of space-time

VI.32.

• 2-split particles ≡ particles with mass ≠ 0:

2 splits influence space-time during particle creation:



where $\sigma_1 \rightarrow 0$ and $\sigma_2 \rightarrow 0$

As σ_1 and σ_2 are independent, during the limiting process $\sigma_1 \rightarrow 0$ and $\sigma_2 \rightarrow 0$, the components of the 2-split spinor grouping "collide" with each other, interacting within the space-time structure in the neighbourhood of the local origin x (shown above). This induces folding around the point x, which consequently generates mass.

A split density of 2 independent splits causes the local origin to fold:

This point-localised folding is the definition of mass. In other words, the interaction of at least two resulting splits within a spinor complex creates mass by causing the associated space-time structure to fold.

Hence: particles with split density ≥ 2 have mass ≠ 0

VI.3.3.

• 3-split particles ≡ formation of charge :

3 splits exert an influence on space-time structure.

The 3 independent splits cause the local origin *x* not only to fold, but also to be compressed. This compression further compactifies the folding that results from the presence of 2 splits.

This point-localised compression creates charge, and in particular

for ... $\Psi\overline{\Psi}$ -sequences ≡ positive charge (≡ taken to be definition of ⊕-charge)
for ... $\overline{\Psi}\Psi$ -sequences ≡ negative charge (≡ taken to be definition of ⊖ -charge)

The fact that charge arises from the presence of 3 splits automatically explains why all charged particles possess mass, as 2 splits are of course already present.

VI.3.4.

- **4-split-particles ≡ <u>charge and mass</u>:**

The presence of 4 splits creates an additional layer of mass over the 3-split state (charge), due to the more complex 4-split density.

Hence: 4-split particles are heavier than the corresponding 3-split particles.
This explains why the proton (a 4-split particle) is heavier than the electron (a 3-split particle).

VI.3.5.

- **5-split-particles ≡ <u>charge and mass</u>:**

Particles that ultimately contain more than 4 point splits are
unstable
due to their high split density, meaning that they cannot form as elementary particles.

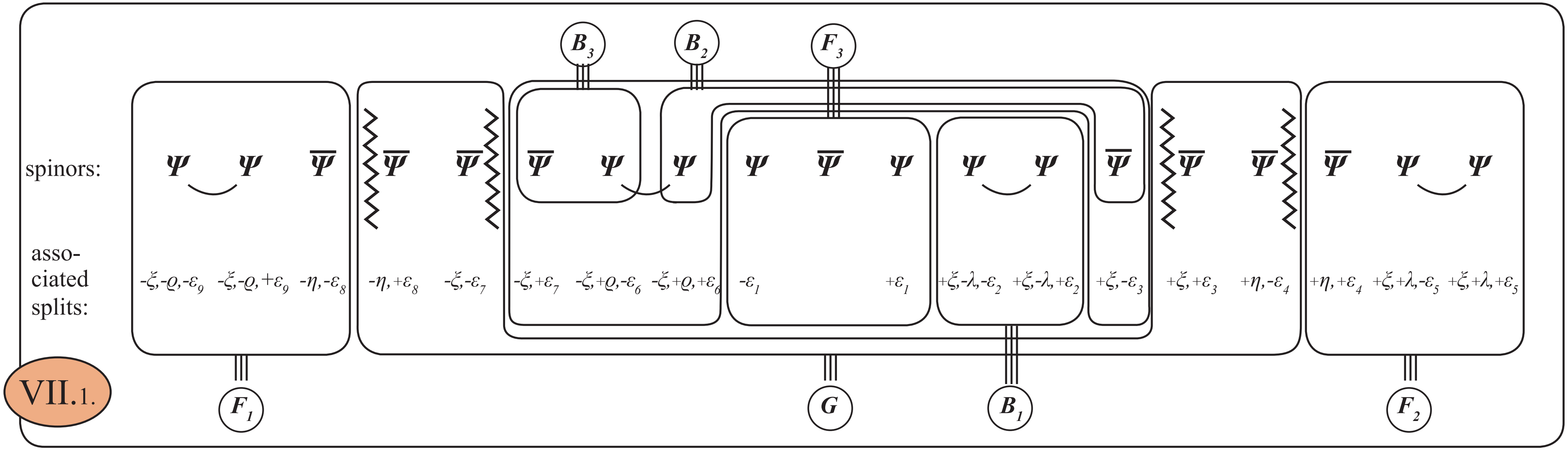
The elementary particle construction process follows in detail from the above:

➡

Preliminary remark: In the following Chapter VII., a self-contained, complete representation of the creation process of all elementary particles is developed. Obviously, such a detailed representation risks being unpleasant reading, stretching block by block over 80 numbered section VII.1 to VII.80, spanning a total of 31 pages. At the end of it, however, a coherent picture of a unified elementary particle theory will have been established.

Chapter VII. The details of the elementary particle creation process:
the matter particles p^+, e^-, ν and the forcer-carriers $St, \gamma, Z(W^\pm), G$
of the strong, electromagnetic, weak and gravitational interactions

The results VI. 3.1 → VI. 3.5 on particle split density reveal the structure of the elementary particle construction process. The creation of each elementary particle consumes a certain subset of the ⑬ point splits σ_{13} available to the process in the form of the spinor system Ψ⑲(x, σ_{13}). The following diagram briefly summarises VI.1. and VI.2. :



VII.1.

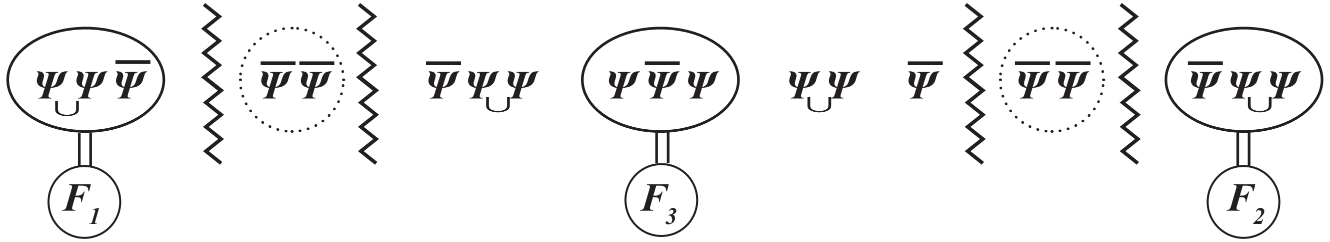
where F_1, F_2, F_3 are elementary fermions, and B_1, B_2, B_3 are elementary bosons,

and G is the system closing agent (≡ system closing force) ≡ gravitation

Particle formation in the structured system $\enclose{circle}{\Psi^{\enclose{circle}{19}}_{\wr\,\cup}}$ is initiated by the separation element ≀ creating the elementary fermion $\enclose{circle}{F_1}$ from VI.1. , or represented structurally:

VII.2.

With VI.1



VII.3.

Thus: from VI.2. it holds that

$$\enclose{circle}{F_1} = F_1(-\xi, -\varrho, -\eta, \enclose{circle}{\varepsilon_9}, -\varepsilon_8) = F_1(\underbrace{-\xi, -\varrho, \enclose{circle}{\varepsilon_9}, -\varepsilon_8}; -\eta)$$

$$\text{So:}\quad F_1 = F_1(\underbrace{-\xi, -\varrho, \pm\,\varepsilon_9, -\varepsilon_8}_{\text{4 Splits}}; -\eta) \equiv \enclose{circle}{\underset{\cup}{\Psi\,\Psi}\,\overline{\Psi}} \text{ is a}$$

4-split elementary fermion (split density 4) **with an unresolved dependency on $\enclose{circle}{-\eta}$.**

VII.4.

So: From VI.3.4., the $\enclose{circle}{F_1}$-elementary fermion – which is still dependent on $\enclose{circle}{-\eta}$ – is an elementary particle with:

$F_1 = \enclose{circle}{\underset{\cup}{\Psi\,\Psi}\,\overline{\Psi}}$:

- masse ≠ 0 (see VI.3.4)
- charge ≠ 0 (see VI.3.4)
- with positive charge due to the $\Psi\,\underset{\sqcup}{\Psi\,\overline{\Psi}}$- sequence (see VI.3.3)
- with an additional mass layer from the presence of the 4th split (see VI.3.4)

Thus: F_1 (4 splits; $-\eta$) possess the same properties as p^+, with an additional split-dependency on $-\eta$.

This $-\eta$-dependency ensures that $F_1 = p^+$ is created before $F_2 = F_2\,(+\eta, \ldots)$ in time, recalling that the η-split is the initiating element for the time-component t (see II.6.)

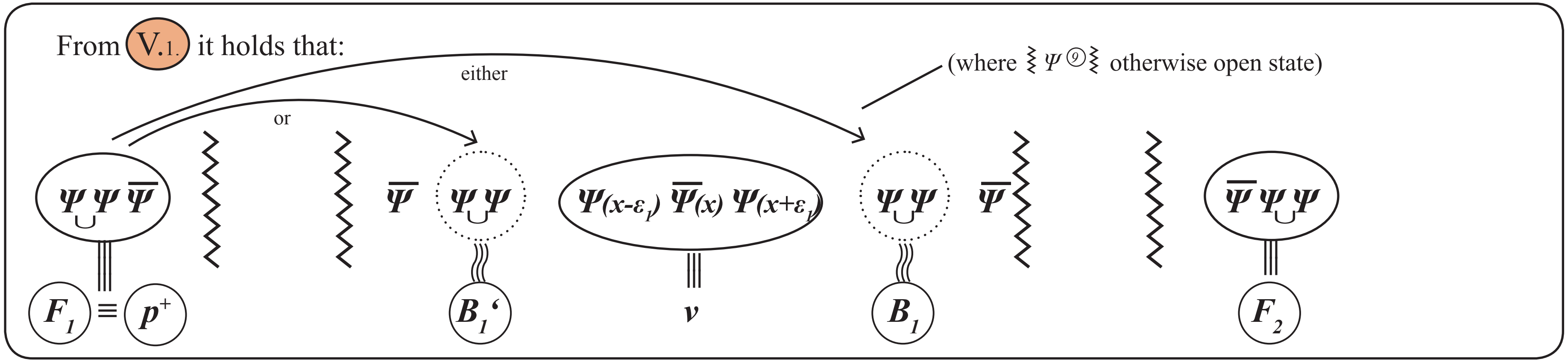
As $F_1 = \underset{\cup}{\Psi\Psi}\overline{\Psi} \equiv p^+, -\eta$ is an interactive elementary fermion, the existence of its interaction implies that there must exist a force boson, which as a “fundamental force boson $_{p+}$“ physically mediates the interaction associated with $F_1 = p^+$.

Hence, from analysis of the overall structure VII.2. it holds that:

Due to the embedded structural binding component „ ∪“ there are only two ways that the fundamental boson $_{p+}$ of p^+ could be constructed from the overall framework VI.1. and VI.2. :

$\Longrightarrow$

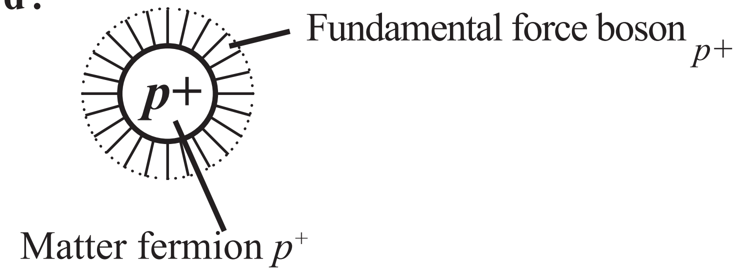
VII.5.



From V.1. it holds that:

So: Either B_1 or B_1‘ must be the fundamental force boson $_{p+}$ of F_1 ≡ (p^+, $-\eta$).

In the elementary creation phase, everything is constructed fundamentally, from first principles, and nothing else is present. Therefore, the fundamental force boson $_{p+}$ must be short-ranged:



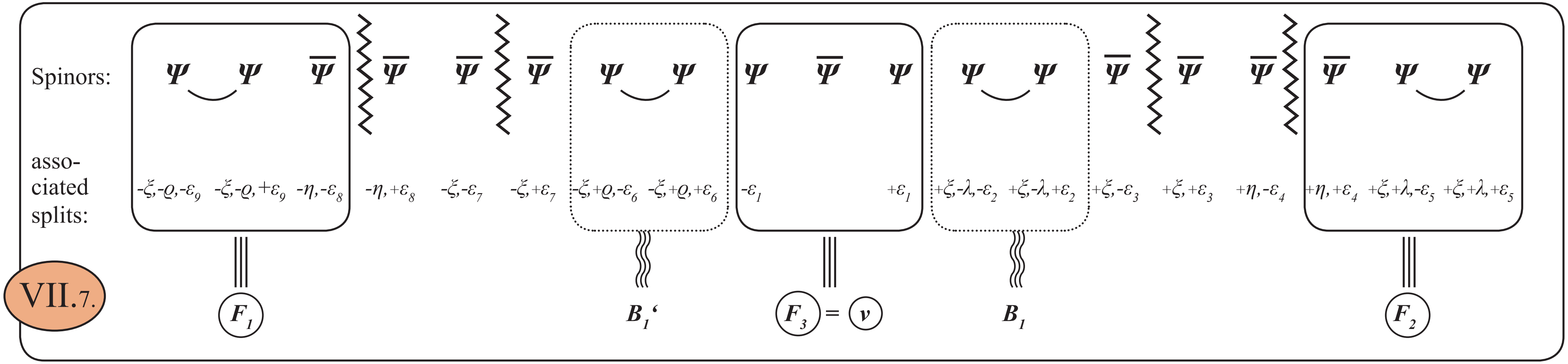
It must be short-ranged, because nothing yet exists that the fundamental force boson $_{p+}$, could by definition interact with – the second elementary fermion F_2 has not yet formed, and nothing can occur in the elementary creation phase without sufficient reason.

VII.6.

Hence: The fundamental force of p^+ – and therefore the force responsible for constructing $p^{\oplus}$ – must be short-ranged.

In order to now identify the fundamental force boson $_{p+}$, the structured $\Psi^{(19)}$ from VII.1. will now be analysed:

VII.7.



where F_1, F_2, F_3 are elementary fermions, and F_1 can be identified as a candidate for p^+, F_2 can be (subsequently) identified as a candidate for e^- from the presence of the $\overline{\Psi}\underset{\cup}{\Psi\Psi}$-sequence, as discussed in VI.3.3. and F_3 can be identified as a candidate for the neutrino, as a 1-split fermion (and hence massless).

So: for the elementary fermions F_1 and F_2, it holds that:

VII.8.

$$F_1 = F_1(-\xi, -\varrho, \varepsilon_9, -\eta, -\varepsilon_8) = F_1(\underbrace{-\xi, -\varrho, \varepsilon_9, -\varepsilon_8}; -\eta)$$

So, if the proton $p^+ \equiv F_1(-\xi, -\varrho, \varepsilon_9, -\varepsilon_8; -\eta)$ is generated as a 4-split particle,

the act of p^+-creation consumes the 4 splits $-\xi, -\varrho, \varepsilon_9, -\varepsilon_8$.

This has immediate consequences for its formal force boson $\enclose{circle}{p+}$, which, from VII.5., is formed

VII.9.

either as $B_1 \equiv \enclose{circle}{\underset{\cup}{\Psi\,\Psi}}\,(+\xi, -\lambda, +\varepsilon_2)$ **or as** $\enclose{circle}{B_1{}^{\text{‘}}}\,(-\xi, -\varrho, -\varepsilon_6)$ **:**

Once the 4 splits have been consumed: $-\xi, -\varrho, \enclose{circle}{\varepsilon_9}, -\varepsilon_8$ to create p^+, it then holds that

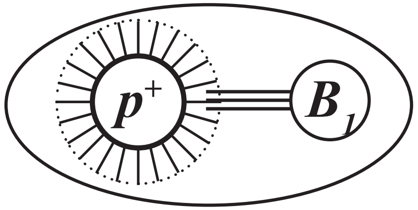
VII.10.

$B_1 \equiv \enclose{circle}{\underset{\cup}{\Psi\,\Psi}}\,(+\cancel{\xi}, -\lambda, +\varepsilon_2) = B_1(-\lambda, +\varepsilon_2)$ **is a 2-split particle**

$\enclose{circle}{B_1{}^{\text{‘}}} \equiv \enclose{circle}{\underset{\cup}{\Psi\,\Psi}}\,(-\cancel{\xi}, -\cancel{\varrho}, -\varepsilon_6) = \enclose{circle}{B_1{}^{\text{‘}}}\,(-\varepsilon_6)$ **would be a 1-split particle**

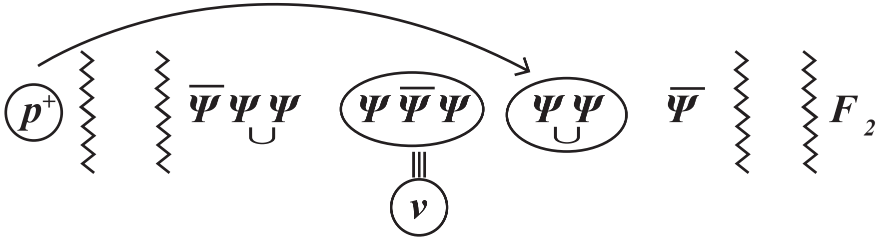
VII.11.

Thus, from VII.7., $\enclose{circle}{B_1}$ is the only candidate for the formal force boson $\enclose{circle}{p+}$ of $\enclose{circle}{p+}$, which must be short-ranged :



VII.12.

Thus: it holds that



This force boson $\enclose{circle}{B_1}$ = $\enclose{circle}{\underset{\cup}{\Psi\Psi}}$ contains the fundamental structural element „∪“ (see IV.8.) and is therefore – as a result of this elementary binding structure – “strongly coherent”, as the structural element „∪“ provides an explicit, strong coherency between the two internal base spinors $\Psi\Psi$.

Thus, the fundamental force boson $\enclose{circle}{p+}$ (fundamental force of $\enclose{circle}{p^+}$) corresponds to what one generally classifies as the “strong force” (which is a force with high magnitude).

Once the elementary fermions

$F_1 \equiv$ **VII.3.** $\equiv F_1(\underbrace{-\xi, -\varrho, \enclose{circle}{\varepsilon_9}, -\varepsilon_8}; -\eta) \equiv \enclose{circle}{\underset{\cup}{\Psi\Psi}\overline{\Psi}} = \enclose{circle}{p^+}$

and its short-ranged formal force boson have been created,

$B_1 \equiv$ **VII.11.** $\equiv B_1(\underbrace{\lambda, \enclose{circle}{\varepsilon_2}}) \equiv \enclose{circle}{\underset{\cup}{\Psi\Psi}}$ = **strong force boson**

the elementary fermion $F_2 = F_2(+\eta, +\varepsilon_4, +\xi, +\lambda, \enclose{circle}{\varepsilon_5})$ **is created:**

VII.13.

The creation of $\enclose{circle}{p^+}$ and $\enclose{circle}{B_1}$ consumes – as described above – the splits $\xi, \varrho, \varepsilon_9, \varepsilon_8; \lambda, \varepsilon_2$ leaving only the 3rd split grouping $\underbrace{\eta, \varepsilon_4, \varepsilon_5}$ available for the formation of the elementary fermion $\enclose{circle}{F_2}$:

VII.14. **So:** $F_2 = F_2(+\eta,+\cancel{\xi},+\cancel{\lambda},+\varepsilon_{4,}\textcircled{ε_5}) \Longrightarrow F_2(+\eta,+\varepsilon_{4,}\textcircled{ε_5})$

VII.15. **So:** $\textcircled{$F_2$}$ **is a** $\boxed{\textbf{3-split particle}}$ **with**

- mass ≠ 0 (see VI.3.3)
- charge ≠ 0 (see VI.3.3)
- with negative charge due to the $\underbrace{\bar{\Psi}\,\Psi}\,\Psi$ - sequence (see VI.3.3)
- without an additional mass layer due to the absence of a 4th split (see VI.3.4)

VII.16. **So:** **The** ($\textcircled{$F_2$}$ (3-split)) **possesses the same properties as the electron** $\textcircled{$e^-$}$

VII.17. **One particular consequence of this is that the electron** ($\textcircled{$e^-$} \equiv \textcircled{$F_2$}$) **, as a** $\boxed{\textbf{3-split particle}}$**, has lower mass than the proton** ($\textcircled{$p^+$} \equiv \textcircled{$F_1$}$)**, which is a** $\boxed{\textbf{4-split particle}}$**.**

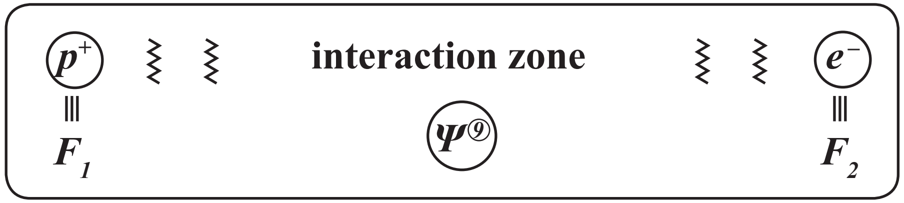
It's also worth noting that each of the 3 primary point splits anchored directly to the origin of interaction $\textcircled{$x$}$**, namely** ξ, η, ε_1 **is used for the creation of a different elementary fermion: specifically** ξ **for** $\textcircled{$p^+$}$, η **for** $\textcircled{$e^-$}$, ε_1 **for** $\textcircled{$\nu$}$**.**

VII.18.

Over the course of the following chain of events, occurring successively in time:

$p^+ \longrightarrow p^+ + B_1 \longrightarrow p^+ + B_1 + e^-$ **the proton** $p^+ = F_1(\underbrace{-\xi, -\varrho, \textcircled{\varepsilon_9}, -\varepsilon_8}; -\eta)$ **loses its -η-dependency with the creation of the electron** $e^- = F_2(\underbrace{+\eta, +\varepsilon_4, \textcircled{\varepsilon_5}})$**, which occurs later in time, consuming the associated η-split.**

Furthermore: as the elementary fermion $F_2 = \overline{\Psi}\,\Psi \underset{\cup}{\,} \Psi = e^-$**, subject to the following structural limitations: (see VII.5.)**



,

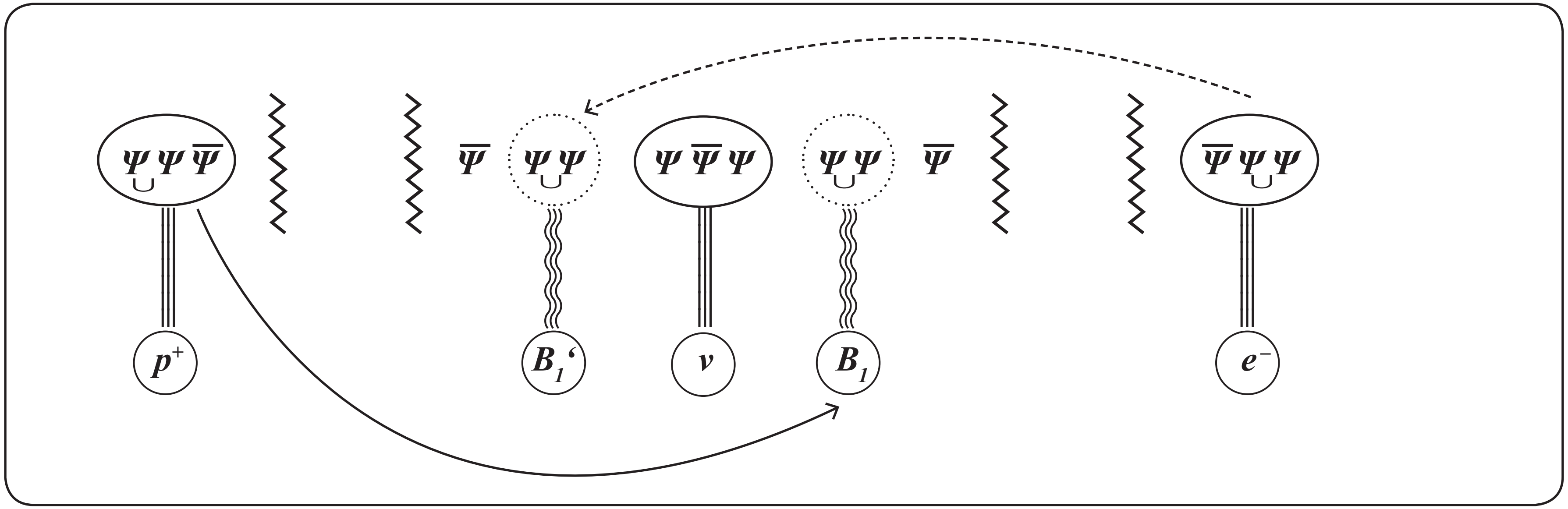
is interactive by nature, there must also exist a force boson associated with F_2 **– analogously to** $F_1 \equiv p^+$ **– :**

VII.19.

This boson, the fundamental force boson of e^-**, mediates the interaction of** $F_2 \equiv e^-$ **.**
Thus: Analogously to VII.5. , the diagram shown below follows for the electron e^- **and its fundamental force boson, once the strong boson** B_1 **has been identified as the fundamental force boson (fundamental force) of** p^+ **:**

⤋

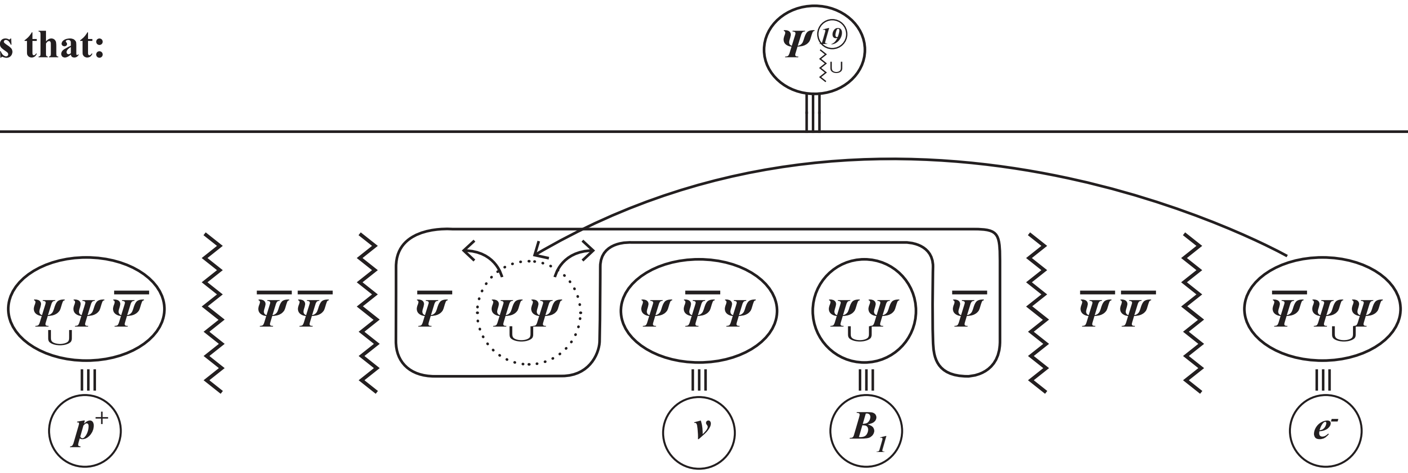
VII.20.



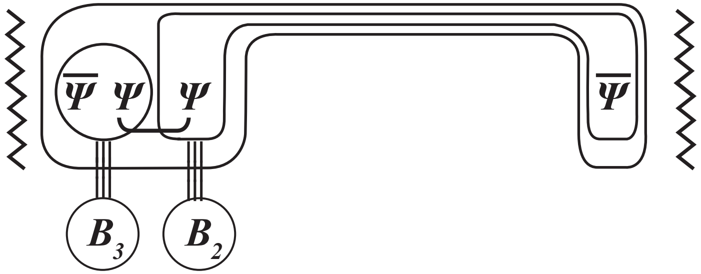
As $B_1‘$ = $\underset{\cup}{\Psi\Psi}$ has identical structure to B_1 = $\underset{\cup}{\Psi\Psi}$ (≡ the fundamental force boson of p^+), the identity principle I.5. prompts the following, new extension of $B_1‘$ (for sections VII.21. and VII.22.), see the version of “Matter, Logic and Existence” dated 06/03/2012, hereafter referred to as M-L-E):

From this, it follows that:

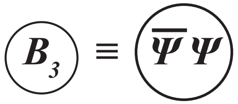
VII.23.



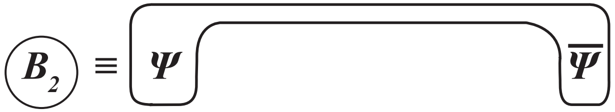
VII.23.1. where



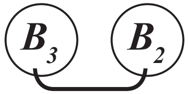
VII.23.2. where



and



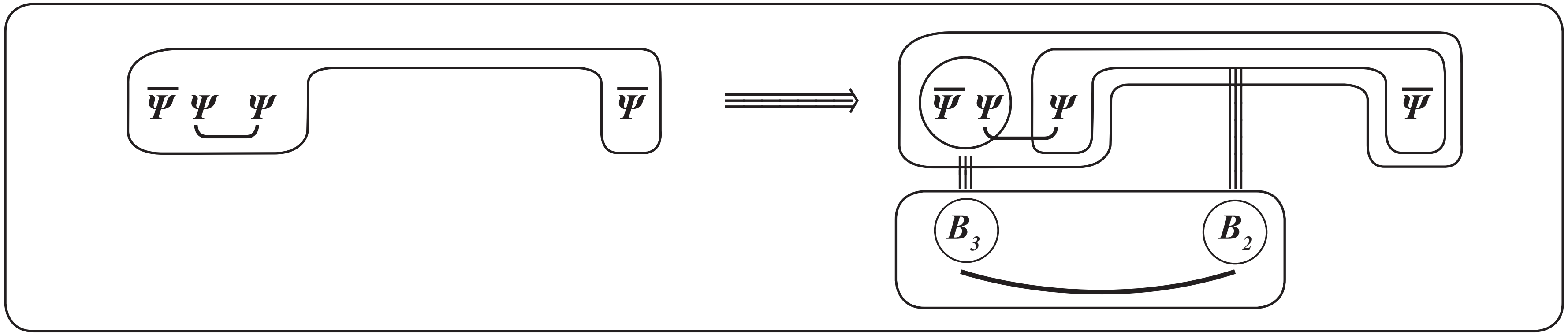
VII.23.3. and where



are coupled together by the fundamental structural binding element

Fulfilling the role of the fundamental force of the electron e^-, this force system VII.24. is the unification of two distinct force components. Given that the strong force boson $B_1{}' = \underset{\cup}{\Psi\Psi}$ has already been generated, and invoking the identity principle I.5., VII.24. must be decomposed into the following two, separate force components $\underbrace{B_2 \quad B_3}$:

VII.24.



From VII.8. once p^+, B_1, e^-, ν have been generated, it has been established that:

neutrino	≡	ν	≡	$\Psi\overline{\Psi}\Psi(\varepsilon_1)$	≡	1-split-particle; ε_1	(see VII.1.)
proton	≡	p^+	≡	$\underset{\cup}{\Psi\Psi}\overline{\Psi}(\xi, \varrho, \varepsilon_9, \varepsilon_8)$	≡	4-split-particle; $\xi, \varrho, \varepsilon_9, \varepsilon_8$	(see VII.3.)
strong int.	≡	B_1	≡	$\underset{\cup}{\Psi\Psi}(\lambda, \varepsilon_2)$	≡	2-split-particle; λ, ε_2	(see VII.10.)
electron	≡	e^-	≡	$\overline{\Psi}\underset{\cup}{\Psi\Psi}(\eta, \varepsilon_4, \varepsilon_5)$	≡	3-split-particle; $\eta, \varepsilon_4, \varepsilon_5$	(see VII.14.)

VII.25.

A total of 10 point splits, specifically – see (VII.1.,3.,10.,14.) –

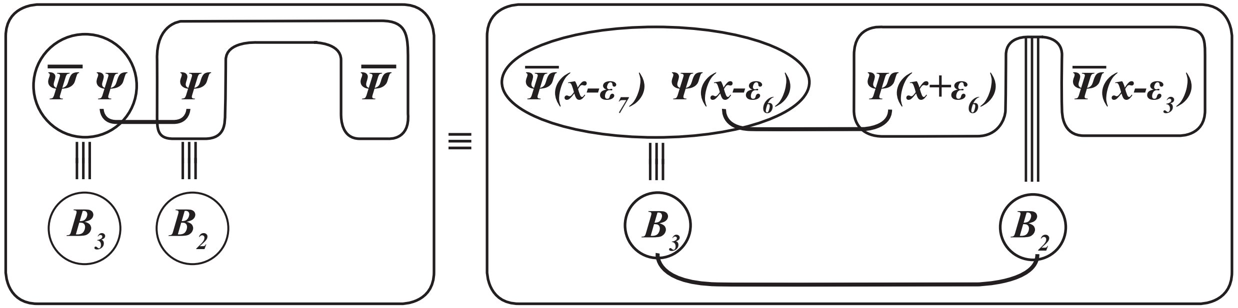
$$\overbrace{\varepsilon_1}^{\nu}\ ;\ \overbrace{\xi,\ \varrho,\ \varepsilon_9,\ \varepsilon_8}^{p^+}\ ;\ \overbrace{\lambda,\ \varepsilon_2}^{B_1}\ ;\ \overbrace{\eta,\ \varepsilon_4,\ \varepsilon_5}^{e^-}$$

have now been consumed for elementary particle creation ((ν), (p^+), (B_1), (e^-)),
from a total of 13 point splits $(\xi, \lambda, \varrho, \eta, \varepsilon_1, \varepsilon_2, \varepsilon_3, \varepsilon_4, \varepsilon_5, \varepsilon_6, \varepsilon_7, \varepsilon_8, \varepsilon_9)$ (see (III.2.))

For the split density of the fundamental force system of the electron (e^-), follows that:

VII.26.

Fundamental force system of the electron (e^-) ≡



VII.27.

Thus: The fundamental force system (B_3 B_2) of the electron (e^-) has the property...

VII.28.

...that two distinct force components $\underbrace{\boxed{B_3 \equiv \bar{\Psi}\,\Psi} \text{ und } \boxed{B_2 \equiv \overline{\Psi \quad \bar{\Psi}}}}$ are fundamentally coupled together via the fundamental structural element „ ∪“ (see IV.4.). The force component B_2, as $B_2 \equiv \boxed{\Psi\ \overline{\nu \quad B_1}\ \bar{\Psi}}$, – whose “construction” was forced by the indirect structure $\boxed{\text{VII.24., VII.26.}}$ – is inherently bound (see VII.22.) to the neutrino ν and the strong boson $B_1 \equiv \underset{\cup}{\bar{\Psi}\,\Psi}$.

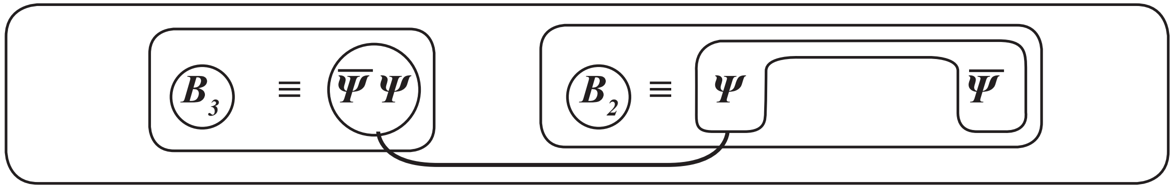
VII.29.

Thus: during the $\boxed{\text{particle creation of } B_2} \equiv \overline{\Psi \quad \bar{\Psi}}$ the coherency alignment of the base spinors $\boxed{\overline{\underset{\longrightarrow}{\Psi(x+\varepsilon_6)} \qquad \underset{\longleftarrow}{\bar{\Psi}(x-\varepsilon_3)}}} \equiv B_2$ gives rise to inherency structure between $\boxed{B_2 \text{ on the one hand, and } \nu \text{ and } B_1 \text{ on the other}}$: $B_2 \equiv \boxed{\underset{\longrightarrow}{\Psi}\ \overline{\nu \quad B_1}\ \underset{\longleftarrow}{\bar{\Psi}}}$

$\boxed{\text{via the point splitting process s } \varepsilon_6 \longrightarrow 0,\ \varepsilon_3 \longrightarrow 0}$

So: The force structure of the electron $F_2 \equiv e^-$ arises from a characteristic process that results in the following $\boxed{\text{compound structure}}$:

VII.30.



where $\boxed{B_2\text{, due to its indirect structure } \boxed{\Psi \sqcap \overline{\Psi}}}$ $\equiv (\overline{\Psi \quad \overline{\Psi}})$ can only achieve coherency between its base spinors $\boxed{\underset{\rightarrow}{\Psi} \sqcap \underset{\leftarrow}{\overline{\Psi}}}$ if the inherency structur $\boxed{\underset{\longrightarrow}{\Psi \quad \nu \quad} \underset{\longleftarrow}{B_1 \quad \overline{\Psi}}}$ of the coherency process $\boxed{\overset{\rightarrow}{\Psi} \quad \overset{\leftarrow}{\overline{\Psi}}}$ shown in VII.27. – and by extension of the particle creation process of B_2 – is indirectly constructed to be “coherent” with the $\boxed{B_1 \equiv \underset{\cup}{\Psi\Psi}(\lambda, \varepsilon_2)}$-structure.

VII.31.

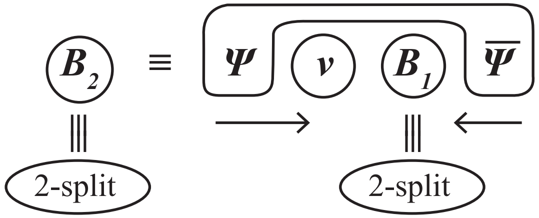
Since B_1, the fundamental force$_{p+}$ of the proton p^+), is a $\boxed{\text{2-split particle}}$, from VII.6., (and thus short-ranged), this same $\boxed{\text{indirect coherency between } B_2 \text{ and } B_1}$ – in other words the $\boxed{\text{inherency between } B_2 \text{ and the strong force } B_1}$ – B_2 must be created as $\boxed{B_2(\varepsilon_6, -\varepsilon_3)}$, that is a $\boxed{\text{2-split force boson}}$, with the same, short-ranged structure as B_1.

VII.32.

Factoring in the split structure VII.27., this means for the second – bound – fundamental force component of the electron e^- namely B_3 :

VII.33.

- one of the force components B_2 ≡ $B_2\ (\varepsilon_6, -\varepsilon_3)$ must be a 2-split particle, as the ε_3- and ε_6-splits are consumed and B_1 consequently structurally aligns with B_1:



From VI.3.2., this 2-split particle must hence be a massive, short-ranged force: the weak, short-ranged force Z

- and the other component B_3 ≡ $\bar{\Psi}\Psi$ = $B_3\ (\varepsilon_7, \cancel{\varepsilon_6})$ = $B_3\ (\varepsilon_7)$ must therefore be a 1-split particle (see VI.3.1.), since the ε_6-split is consumed for B_2, and hence must be a long-ranged force: the so-called electromagnetic force $\gamma \equiv B_3$

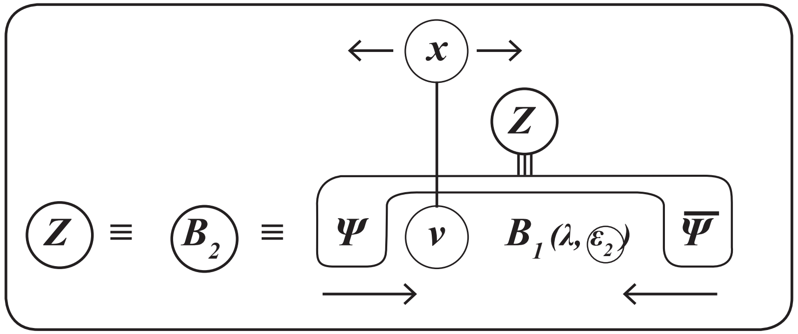
Regarding the magnitude of these forces, the following holds:

VII.34.

- B_2 is only weak, due to the indirect coherency $\underset{\rightarrow}{\Psi}\ \ldots\ \underset{\leftarrow}{\bar{\Psi}}$ of its internal base spinors
- B_3 has "normal" magnitude, due to the normal coherency $\underset{\rightarrow\leftarrow}{\bar{\Psi}\Psi}$ of its internal base spinors, corresponding to what we know as the "medium-strength" electromagnetic force.

VII.35.

The weak force Z = B_2 has a (see VII.23.), "structural anomaly" from its inherent structure, meaning that for Z ≡ weak force the so-called parity symmetry (invariance under parity transformations) is broken.



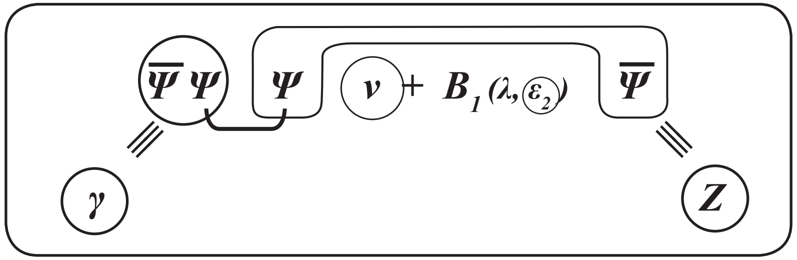
VII.36.

Thus: The structure of the weak force ≡ Z is chiral (see M-L-E, chapter VII. for details).

Of course, this does not hold for the electromagnetic force γ coupled to the weak force by „∪“.

The reason for this is that γ has direct coherency between its internal base spinors $\gamma = \overline{\Psi}\,\Psi$.

For details see M-L-E, chapter VII. (i.e. VII.23. → VII.37.)



Furthermore, due to the characteristic, inherent structure of the weak force $\textcircled{$B_2$} \equiv \textcircled{$Z$} \equiv \boxed{\Psi\ \boxed{\textcircled{ν}+\textcircled{B_1}}\ \overline{\Psi}}$, follows :

The weak force exists only as an inherently linked force couple comprised of the neutrino $\textcircled{$\nu$}$ and strong force $\textcircled{$B_1$}$

Which also means: the neutrino $\boxed{\textcircled{$F_3$} \equiv \textcircled{$\nu$} \equiv \boxed{\Psi(x-\varepsilon_1)\ \overline{\Psi}(x)\ \Psi(x+\varepsilon_1)}}$ is a 1-split particle (and therefore massless from VI.3.1.), and as a force fermion anchored to the origin of interaction $\textcircled{$x$}$ is systemically linked to the weak force, due to the inherency described in VII.29. .

But the neutrino $\textcircled{$\nu$}$, a particle created in the interaction zone $\wr\Psi^{\textcircled{9}}\wr$, cannot itself interact with other particles created in the same zone – so, it cannot interact with $\textcircled{$B_1$} \equiv \textcircled{$St$}$ or $\textcircled{$B_3$} \equiv \textcircled{$\gamma$}$. In the exact same way, the $\boxed{\text{electromagnetic force particle}}$ $\textcircled{$B_3$} \equiv \textcircled{$\gamma$}$ and the $\boxed{\text{strong force particle}}$ $\textcircled{$B_1$} \equiv \textcircled{$St$}$ cannot interact with any of the other particles created in the interaction zone $\wr\Psi^{\textcircled{9}}\wr$. The system's fundamental structure makes any such interactions impossible.

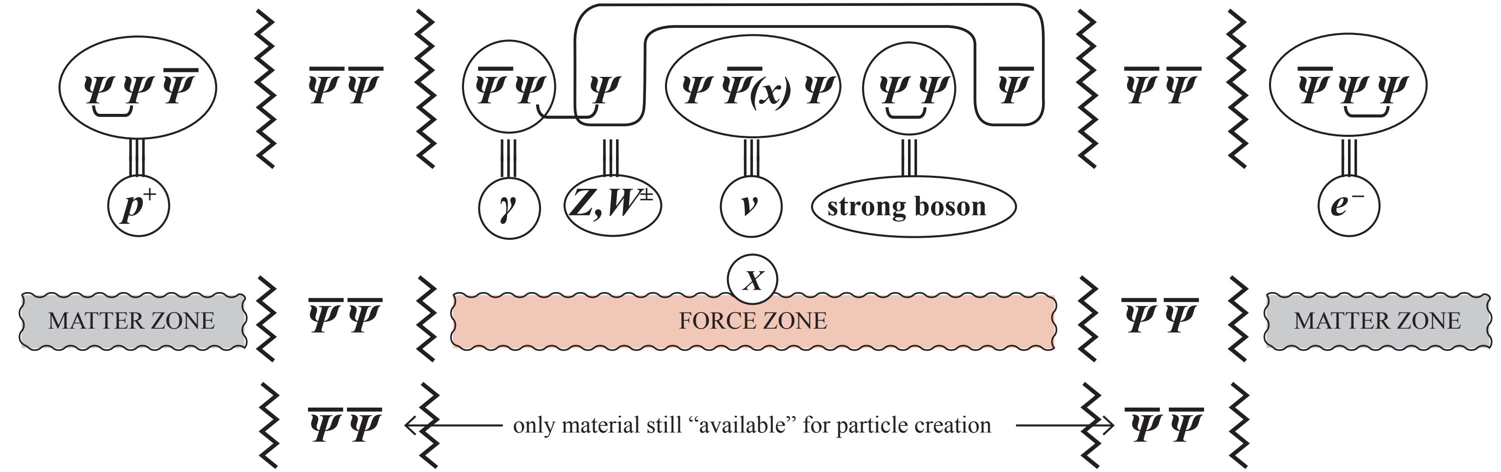
VII.37.

Hence: Wherever the weak interaction exists, the neutrino $\textcircled{$\nu$}$ is also present: $\Rrightarrow$
The neutrino $\textcircled{$\nu$}$ can only interact with the weak force.
The neutrino $\textcircled{$\nu$}$ cannot interact with the strong force.
The neutrino $\textcircled{$\nu$}$ cannot interact with the electromagnetic force.
The neutrino $\textcircled{$\nu$} = \boxed{D^{\textcircled{1}}_{\varepsilon_1}\Psi(x)}$ is a massless fermion, fundamentally dynamically created at the local origin $\textcircled{$x$}$ by the ε_1-split $\boxed{\textcircled{$x-\varepsilon_1$}\ \textcircled{$x$}\ \textcircled{$x+\varepsilon_1$}}$
As a massless particle, it cannot interact with the gravitational force.

After the particles $\textcircled{\nu}$, $\textcircled{B_1}$, $\textcircled{B_2}$, $\textcircled{B_3}$ have formed, the structure of the interaction zone $\wr\Psi^{⑨}\wr$ is fully formed, and after the matter particles $\textcircled{p^+}$ and $\textcircled{e^-}$ have been formed from the matter zone together with their associated fundamental forces, the description of the act of elementary particle creation is fundamentally and structurally almost complete.

VII.38.

The system as a whole is arranged like this:



By the action of the identity principle (I.5.), both of the identical formations from (VII.38.), $\wr\overline{\Psi}\overline{\Psi}\wr$ and $\wr\overline{\Psi}\overline{\Psi}\wr$ cannot form as distinct objects, as that would result in the existence of 2 identical particles $\wr\overline{\Psi}\overline{\Psi}\wr$, violating said identity principle (I.5.).
The identity principle must therefore be invoked, acting as follows:

VII.39.

$$\wr\overline{\Psi}\overline{\Psi}\wr \qquad \wr\overline{\Psi}\overline{\Psi}\wr \quad \Rrightarrow \quad \boxed{\wr\overline{\Psi}\overline{\Psi}\wr\wr\overline{\Psi}\overline{\Psi}\wr}$$

Thus: by invoking the identity principle (I.5.), (VII.39.) causes the $\boxed{\text{2 identical } \wr\overline{\Psi}\overline{\Psi}\wr}$ to merge into a new, physical entity $\boxed{\wr\overline{\Psi}\overline{\Psi}\wr\ \ \wr\overline{\Psi}\overline{\Psi}\wr \equiv \textcircled{G}}$, which is the system closing force, given the name of gravitation.

Because of this, it follows that:

The creation of gravitation brings about the system-wide closing process $\textcircled{\Psi^{\textcircled{19}}_{\wr\cup}}$, with the following gravitational structure: once everything has formed (both in the matter zone and the force zone), and in particular once all 13 point splits of the system: $D^{\textcircled{13}}\Psi(x, \sigma_{13})$ where $\sigma_{13} = (\xi, \lambda, \varrho, \eta, \varepsilon_{1,} \varepsilon_{2,} \varepsilon_{3,} \varepsilon_{4,} \varepsilon_{5,} \varepsilon_{6,} \varepsilon_{7,} \varepsilon_{8,} \varepsilon_{9,})$ (see (V.1.),(V.2.)) have been consumed by the particle creation processes:

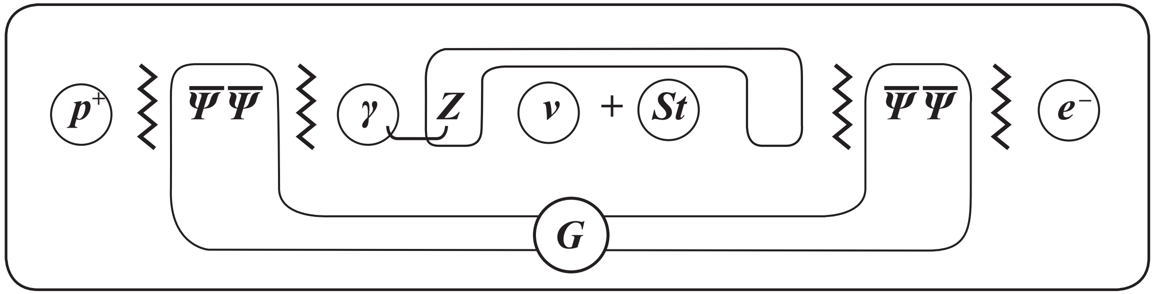
$$\boxed{\begin{array}{l} \textcircled{\nu} = 1 \text{ split},\ \textcircled{p^{+}} = 4 \text{ splits},\ \textcircled{e^{-}} = 3 \text{ splits},\ \textcircled{St} = 2 \text{ splits},\ \textcircled{Z} = 2 \text{ splits},\ \textcircled{\gamma} = 1 \text{ split} \\ \text{for a total of } \equiv \ \ 13 \text{ Splits} \end{array}} \qquad \text{(VII.40.)}$$

mass can no longer be generated, as there are no remaining open point splits during the formation of the final particle $\boxed{\textcircled{G} \equiv \wr\overline{\Psi}\overline{\Psi}\wr\ \wr\overline{\Psi}\overline{\Psi}\wr}$, so:

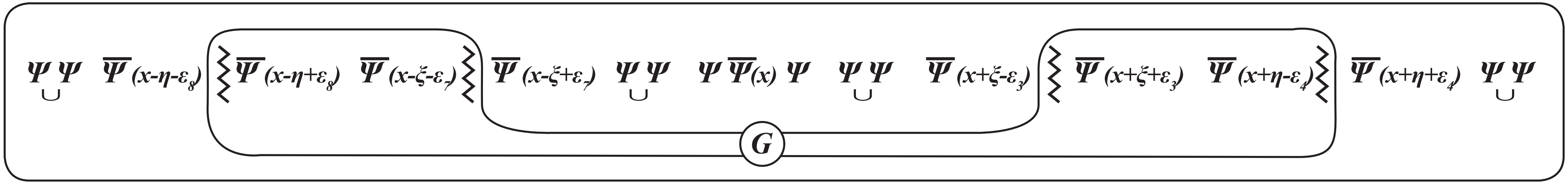
Once the mass structure, and thus the point-folded structure of the system $D^{\textcircled{13}}\Psi(x, \sigma_{13}) \equiv \textcircled{\Psi^{\textcircled{19}}_{\wr\cup}}$ has been in (x, σ_{13}), the point split-separated neighbourhood of the origin of interaction x, the force known as gravitation $\boxed{\textcircled{G} \equiv \wr\overline{\Psi}\overline{\Psi}\wr\ \wr\overline{\Psi}\overline{\Psi}\wr}$ (see (VII.39.)) is then formed, effectively as a system-wide closing force.

Thus: $\boxed{\text{Ⓖ} \equiv \wr\,\overline{\Psi}\,\overline{\Psi}\,\wr\;\;\wr\,\overline{\Psi}\,\overline{\Psi}\,\wr}$ is a (0-split) particle, and so is massless (see (VI.31.)). Consequently, Ⓖ is a long-ranged, total force. Hence, the system $\Psi^{⑲}_{\wr\cup}$ is now arranged in the following configuration:

VII.41.



Note: gravitation Ⓖ is a compound entity, with a characteristic, explicit internal structure. In order to analyse this structure, the construction of Ⓖ within the system-wide context of particle creation will be studied.
For Ⓖ, before particle formation begins, it holds that (siehe (VII.7.)):



which gives the following, originary point split structure for Ⓖ, before particle formation begins:

VII.42.

$$\boxed{\boxed{\text{Ⓖ} \equiv \wr\,\overline{\Psi}\,\overline{\Psi}\,\wr\;\;\wr\,\overline{\Psi}\,\overline{\Psi}\,\wr} \quad\equiv\quad \boxed{G\,(\xi,\,\eta,\,\varepsilon_{3},\,\varepsilon_{4},\,\varepsilon_{7},\,\varepsilon_{8})}}$$

As, during particle creation:

VII.43.

$\textcircled{p^+}$	$=$	$p^+(\xi, \varrho, \varepsilon_9, \varepsilon_8)$	**4-splits**	$\xi, \varrho, \varepsilon_9, \varepsilon_8$	**are consumed**
$\textcircled{e^-}$	$=$	$e^-(\eta, \varepsilon_4, \varepsilon_5)$	**3-splits**	$\eta, \varepsilon_4, \varepsilon_5$	**are consumed**
$\textcircled{\nu}$	$=$	$\nu(\varepsilon_1)$	**1-split**	ε_1	**is consumed**
$\textcircled{B_1}$	$=$	$B_1(\lambda, \varepsilon_2)$	**2-splits**	λ, ε_2	**are consumed**
$\textcircled{B_2}$	$=$	$B_2(\varepsilon_3, \varepsilon_6)$	**2-splits**	$\varepsilon_3, \varepsilon_6$	**are consumed**
$\textcircled{B_3}$	$=$	$B_3(\varepsilon_7)$	**1-split**	ε_7	**is consumed**

Consequently, it follows for $\textcircled{G}$ that:

VII.44.

$$\textcircled{G} = G(\xi, \eta, \varepsilon_3, \varepsilon_4, \varepsilon_7, \varepsilon_8) \longrightarrow G(\cancel{\xi}, \cancel{\eta}, \cancel{\varepsilon_3}, \cancel{\varepsilon_4}, \cancel{\varepsilon_7}, \cancel{\varepsilon_8})$$

$$\equiv G(0) \equiv \textbf{0-split-particle} \equiv \textbf{massless} \equiv \textbf{long-range force}$$

Thus: $\boxed{\textcircled{G} \equiv \text{gravitation}}$ does indeed correspond to what is known as gravitation in reality.

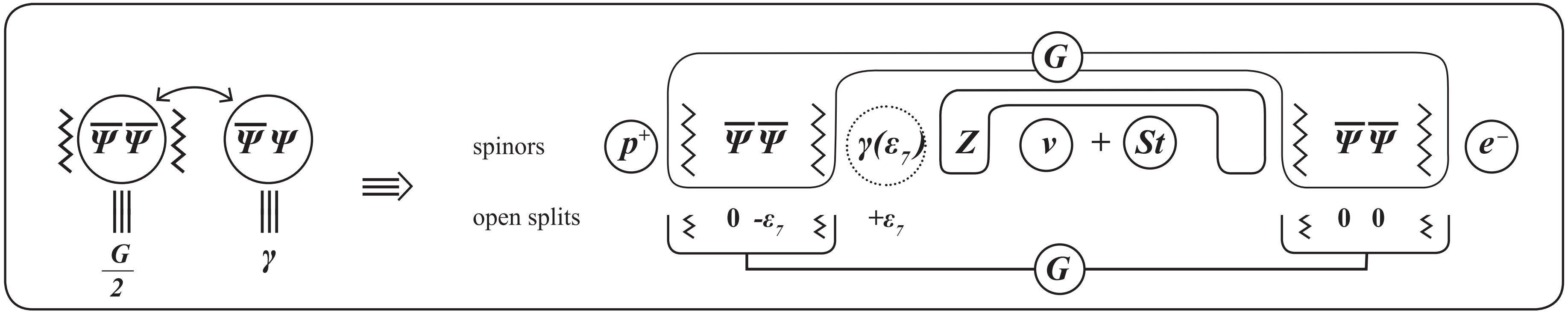
Also, it holds that: gravitation possesses different structural properties from the 3 forces created in the interaction zone $\wr\Psi^{\textcircled{9}}\wr$ (strong, weak, electromagnetic forces):

Gravitation, formed outside of the interaction zone $\wr\,\Psi^{\textcircled{9}}\,\wr$ “interacts” indirectly as an effective total force (0-split particle) with the 3 forces created within the force zone $\wr\,\Psi^{\textcircled{9}}\,\wr$, assuming the corresponding force-particle contains 2 or more point splits, and so has mass.

Thus, a gravitational force (see VII.41) is created in the intermediate zone $\boxed{\wr \quad \wr\wr \quad \wr}$ that acts on all massive elementary particles and forces, regardless of whether they were created in the matter zone or the force zone. The reason for this is that gravitation G effectively forms in the intermediate zone – the zone between the matter zone and the force zone – at the end of the creation process(see VII.39.)

There is one other noteworthy feature: there is an characteristic particularity in the relation between G and the long-ranged electromagnetic force γ, recalling from (see VII.31.) that $\boxed{\gamma \equiv \gamma(\varepsilon_7)}$.
If one assumes that $\gamma(\varepsilon_7)$ has not yet been formed, but that all other particles already have been, the diagram shown below follows from the structural layout of the components (siehe VII.7.)

VII.45.



Hence: in the point split structure of both long-ranged forces, there forms an internal split-relation :

$\rightarrow$ **electromagnetic force** $\gamma = \gamma\,(+\varepsilon_7)$

$\rightarrow$ **gravitation** $G = G\,(-\varepsilon_7)$

But: it would also be possible for the following split structure to occur – without having to modify the overall system structure $\Psi^{⑲}_{\wr\cup}$ **in any way:**

VII.46.

either $\gamma\,(\varepsilon_7);\ G\,(0)$ **so** γ **≡ 1-split-particle**
G **≡ 0-split-particle**
So (γ) **forms first followed by** (G)

or $G\,(\varepsilon_7);\ \gamma\,(0)$ **so** G **≡ 1-split-particle**
γ **≡ 0-split-particle**
So (G) **forms first followed by** (γ)

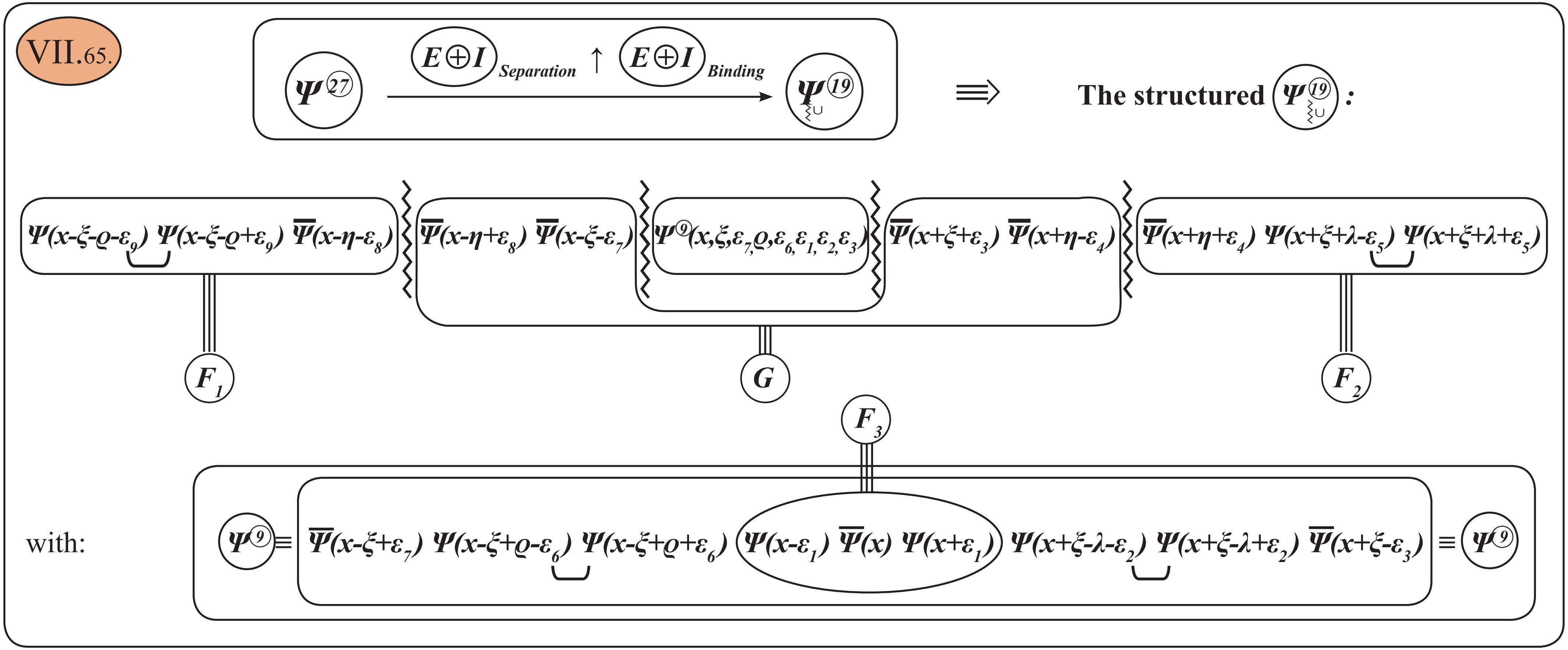
But since both 0-split and 1-split particles do not possess mass (see VI.3.) – and are therefore long-ranged – this means that: both long-ranged, massless forces (γ) **and** (G) **must be related through the shared point split** (ε_7)**.**

Sections VII.47. to VII.64. are given in the original version of M-L-E:
In the original version of M-L-E (Matter, Logic and Existence, 06/03/2012), in Appendix ②., see VII.47. to VII.56., the structure of the characteristic energy threshold for gravitation (gravitational interaction) is studied, arriving at the conclusion that an ascertainable, extremely high gravitational energy threshold (~ 10^{19} GeV) exists, above which the gravitational force collapses, or is superseded by other force structures.
Furthermore, in the original version of M-L-E , in Appendix ③., see VII.57. to VII.64., the systemic creation structure of a total of 6 elementary particles is derived from the (6-$\hbar$) total structure $\Psi^{㉗}(x,\sigma)$**.**

The spinor-based, local origin of each of the 6 fundamental quanta ($\hbar$) can also be definitively traced back to a dynamic root in each of the particle construction processes (see VII.50.).

The next section explores this by analysing the structured spinor complex $\Psi^{\text{⑲}}_{\wr\cup}$, generated from VII.60. $\equiv$ $\Psi^{\text{㉗}}(x,\sigma_{13})$ via the structuring process:

VII.65.



$$\Psi^{\text{㉗}} \xrightarrow{\boxed{E\oplus I}_{Separation} \uparrow \boxed{E\oplus I}_{Binding}} \Psi^{\text{⑲}}_{\wr\cup} \Rrightarrow$$

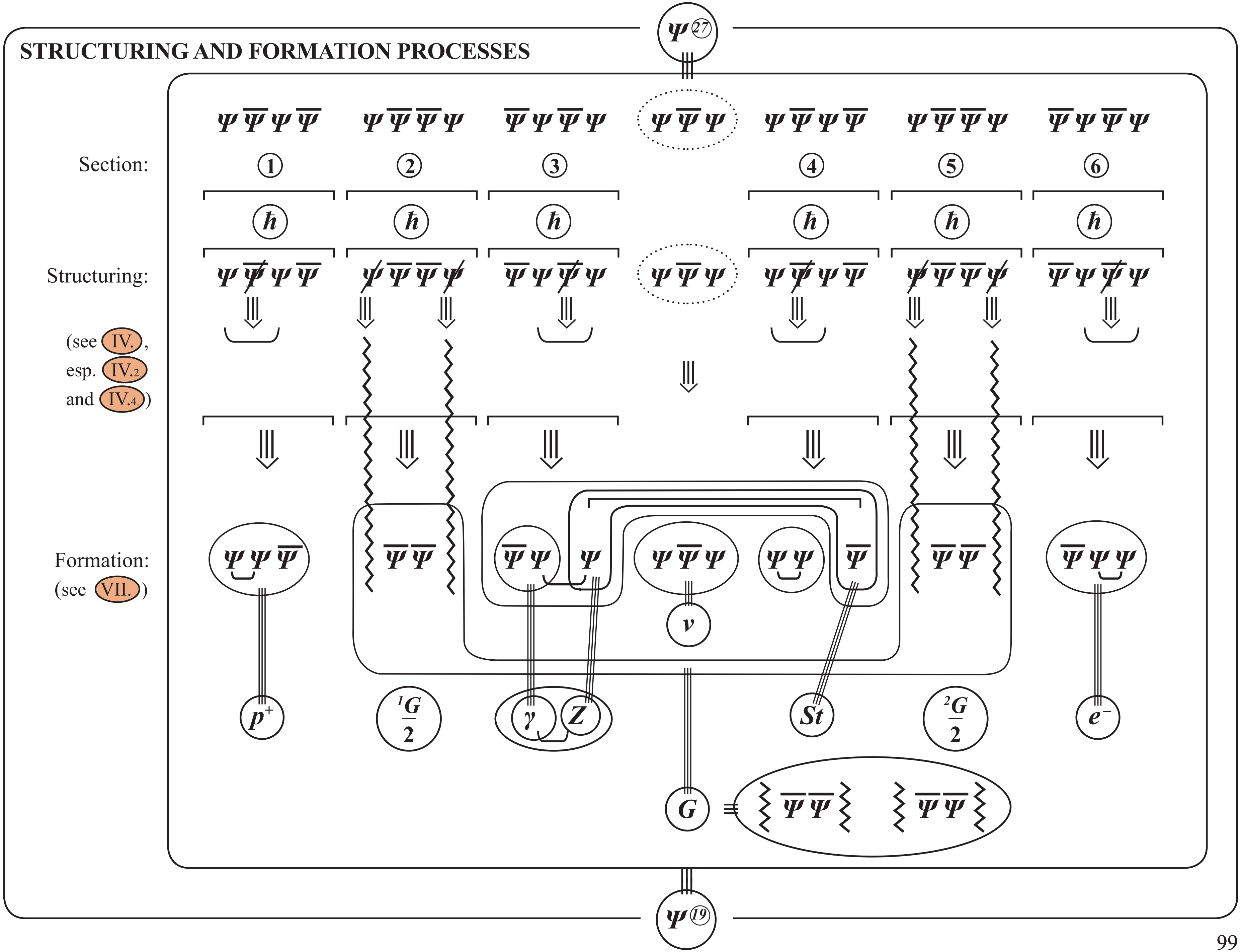
The structured $\Psi^{\text{⑲}}_{\wr\cup}$:

$$\Psi(x-\xi-\varrho-\varepsilon_9)\ \Psi(x-\xi-\varrho+\varepsilon_9)\ \overline{\Psi}(x-\eta-\varepsilon_8) \wr \overline{\Psi}(x-\eta+\varepsilon_8)\ \overline{\Psi}(x-\xi-\varepsilon_7) \wr \Psi^{\text{⑨}}(x,\xi,\varepsilon_7,\varrho,\varepsilon_6,\varepsilon_1,\varepsilon_2,\varepsilon_3) \wr \overline{\Psi}(x+\xi+\varepsilon_3)\ \overline{\Psi}(x+\eta-\varepsilon_4) \wr \overline{\Psi}(x+\eta+\varepsilon_4)\ \Psi(x+\xi+\lambda-\varepsilon_5)\ \Psi(x+\xi+\lambda+\varepsilon_5)$$

with:

$$\Psi^{\text{⑨}} \equiv \overline{\Psi}(x-\xi+\varepsilon_7)\ \Psi(x-\xi+\varrho-\varepsilon_6)\ \Psi(x-\xi+\varrho+\varepsilon_6)\ (\Psi(x-\varepsilon_1)\ \overline{\Psi}(x)\ \Psi(x+\varepsilon_1))\ \Psi(x+\xi-\lambda-\varepsilon_2)\ \Psi(x+\xi-\lambda+\varepsilon_2)\ \overline{\Psi}(x+\xi-\varepsilon_3) \equiv \Psi^{\text{⑨}}$$

It can be shown that: $\Psi^{\text{⑲}}$ is created from the 6-quanta system $\Psi^{\text{㉗}}(x,\sigma_{13})$ $\equiv$ VII.50. in the following way: ➡


STRUCTURING AND FORMATION PROCESSES

However, as explained in VII.39. by invoking the identity principle I.5., $\frac{{}^1G}{2}$ and $\frac{{}^2G}{2}$ must be coupled together,

VII.67. **forming $\textcircled{G} \equiv \boxed{\frac{{}^1G}{2} \;\_\_\_\; \frac{{}^2G}{2}} \equiv \boxed{\wr\, \overline{\Psi}\,\overline{\Psi}\, \wr \quad \wr\, \overline{\Psi}\,\overline{\Psi}\, \wr}$**

and giving rise to the system-wide closing force (≡ gravitation) .

VII.68. **Because of this, the $\hbar$ created in the 5th section of the overall system VII.66.**

is shifted into the only segment of VII.66. that was previously $\hbar$-free, namely $\Psi\,\overline{\Psi}\,\Psi$

The reason that this segment is still $\hbar$-free is because it only contains 3 spinors.

VII.69 **This shift causes the neutrino $\nu \equiv \boxed{\underset{-\varepsilon_1}{\Psi}\;\underset{0}{\overline{\Psi}}\;\underset{+\varepsilon_1}{\Psi}}$ to acquire a structural quantum $\hbar$,**

allowing the following characteristic rule to be established for elementary particles :

Every elementary particle contains exactly one structural quantum $\hbar$. The acquisition of this structural quantum is subject to fundamental and structural factors during partitioning VII.60. and rearrangement VII.66. .

Now that the underlying point split structure $\Psi^{\textcircled{27}}(x,\sigma_{13})$ (see VII.60.) and the resulting elementary particle creation processes (see e.g. VII.7., VII.25., VII.38 , VII.40., VII.43., VII.44.) have been established, the following internal constituent and point split structures can be laid out for each elementary particle in turn:

Internal constituent and point split structure of all elementary particles

VII.70.

Proton: p^+ ≡ $\underset{\cup}{\Psi}\Psi\overline{\Psi}$ $(-\xi, -\varrho, -\varepsilon_8, \pm\varepsilon_9)$ ≡ **3-base spinor - 4-split -object** **1 ħ**

Electron: e^- ≡ $\overline{\Psi}\underset{\cup}{\Psi}\Psi$ $(+\eta, +\varepsilon_4, \pm\varepsilon_5)$ ≡ **3-base spinor - 3-split -object** **1 ħ**

Neutrino: ν ≡ $\Psi\overline{\Psi}\Psi$ $(\pm\varepsilon_1)$ ≡ **3-base spinor - 1-split -object** **1 ħ**

Strong interaction: St ≡ $\underset{\cup}{\Psi}\Psi$ $(-\lambda, \pm\varepsilon_2)$ ≡ **2-base spinor - 2-split -object** **1 ħ**

Electromagnetic-weak interaction: $\gamma\,Z$ ≡ $\overline{\Psi}\Psi \quad \Psi \quad \overline{\Psi}$ $(-\varepsilon_3, \pm\varepsilon_6, +\varepsilon_7)$, **1 ħ**

**with the following two distinct components, coupled together by „ ∪”,
but still independently existing (see VII.23. to VII.33)**

Z ≡ $\Psi \ \dots \ \overline{\Psi}$ $(+\varepsilon_6, -\varepsilon_3)$ ≡ **2-base spinor - 2-split -object**

γ ≡ $\overline{\Psi}\Psi$ $(+\varepsilon_7)$ ≡ **2-base spinor - 1/0-split -object**

Gravitational interaction: G ≡ $\overline{\Psi}\,\overline{\Psi} \quad \overline{\Psi}\,\overline{\Psi}$ $(-\varepsilon_7)$ ≡ **4-base spinor - 0/1-split -object,** **1 ħ**

with γ / G association, see VII.46.

Thus: Due to their point split structure, in the overall elementary particle system $\Psi^{19}_{\cup}$, the only elementary particles that carry charge[1] are the proton p^+ and the electron e^-, as only p^+ and e^- (by VII.70.) contain 3 or more point splits. Recall from VII.3.3. that charge is only created for particles with point split density ≥ 3.

It follows that:
Since the total system $\Psi^{19}_{\cup}$ must be charge-neutral on balance, there can only be one (single) elementary charge q

VII.70.1.

This elementary charge must exist – from VII.3.3. – in
- **a „positive form” ($\triangleq p^+$) and in**
- **a „negative form“ ($\triangleq e^-$) ,**

that both have identical “absolute value”.

Distinguishing between the q^+ and q^- forms of the elementary charge q is the only way to achieve the required charge neutrality in the elementary particle system $\Psi^{19}_{\cup}$, i.e. for the sum total of charge$_{p^+}$ and charge$_{e^-}$ to be zero.

According to VII.70. the Graviton G is the only 4-base spinor-elementary particle. Possibly a 4-constituent-object also should be searched for within the standard-model in order to find a connection to the gravitational force then.

---

[1] **Remark:** The fact that the $W^{\pm}$-boson is charged originates from the proton or electron split shift towards the Z-boson that occurs during the $W^{\pm}$-processes (for the details, see X.1.21.)
Thus: During these $W^{\pm}$-processes, the electron or proton is transformed into a neutrino via a split transfer and resulting split shifts.
Thus: These $W^{\pm}$-processes proceed according to a completely different mechanism (see X.1.21. and X.1.).

By analysing the overall split structure of $\Psi^{\textcircled{19}}(x,\sigma_{13})$ (presented in more detail in VII.71. to VII.76. from M-L-E), one can recognise a systemically arising characteristic of elementary particles: every one of these elementary particles contains a complete $\pm\varepsilon_v$-split – i.e. an ε_v-split object – or to be more specific (see VII.70.):

VII.77.

$$p^+ \equiv p^+(-\xi, -\varrho, -\varepsilon_8, \pm\varepsilon_9) \equiv \textbf{proton}$$

$$e^- \equiv e^-(+\eta, +\varepsilon_4, \pm\varepsilon_5) \equiv \textbf{electron}$$

$$v \equiv v\,(\pm\varepsilon_1) \equiv \textbf{neutrino}$$

$$St \equiv St\,(-\lambda, \pm\varepsilon_2) \equiv \textbf{strong interaction}$$

$$\gamma\,Z \equiv \gamma\,Z\,(-\varepsilon_3, \pm\varepsilon_6, +\varepsilon_7) \equiv$$

electromagnetic-weak interaction, with the two structurally linked but individually existing components:

$Z = Z\,(+\varepsilon_6, -\varepsilon_3)$, **and** $\gamma = \gamma\,(+\varepsilon_7)$

VII.78.

Thus: the 6th elementary particle does not correspond to gravitation as a singular entity – that is to say the 6th particle is not just the graviton on its own – but instead to the gravitational-electromagnetic force, with internal structure provided by the fundamental separating element ≀ :

$$G \wr \gamma\ (\pm\varepsilon_7)$$

Thus: from the overall 6-quanta structure VII.60., the 6 fundamentally existing elementary particles are:

VII.79.

Matter particles:

$p^{+} \; (-\xi, -\varrho, -\varepsilon_8, \pm\varepsilon_9)$ ≡ **proton**

$e^{-} \; (+\eta, +\varepsilon_4, \pm\varepsilon_5)$ ≡ **electron**

$\nu \; (\pm\varepsilon_1)$ ≡ **neutrino**

Force particles:

$St \; (-\lambda, \pm\varepsilon_2)$ ≡ **strong interaction**

$\gamma \, Z \; (-\varepsilon_3, \pm\varepsilon_6, +\varepsilon_7)$ ≡ **electromagnetic-weak interaction**

$G \wr \gamma \; (\pm\varepsilon_7)$ ≡ **gravitational-electromagnetic interaction**

VII.80.

Thus: the association $G \wr \gamma \; (\pm\varepsilon_7)$

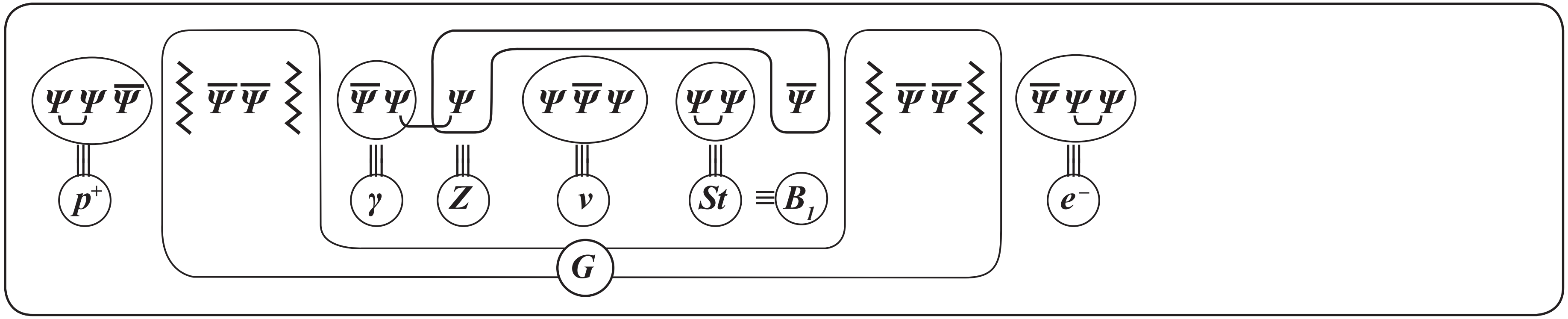
gives a dynamically generated, split-based relationship between gravitation G and the electromagnetic interaction γ that effectively holds over the whole structure

Chapter VIII. Concurrence of individual particle creation processes

Chapter VIII.1. Force magnitudes for each interaction

The interaction structure of the system as a whole is:

VIII.1.1.



where the magnitude of the force associated with each interaction (St, γ, Z, G) depends on the coherency structure of the internal base spinors making up each force – or to be precise, each force boson.
The following is an immediate consequence for each individual interaction:

VIII.1.2.

The strong interaction: $St \equiv \underset{\cup}{\Psi\Psi}$ **contains the fundamental structural binding component „∪“, that is to say that the internal base spinors** $\underset{\cup}{\Psi\Psi}$ **are coupled together by the fundamental structural binding component „∪“. Thus, in the** $\boxed{\text{point-splitting process } (\lambda,\ \varepsilon_2) \rightarrow 0}$ **, they are strongly coherent. So:**

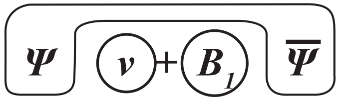
$St \equiv \boxed{\underset{\rightarrow\leftarrow}{\underset{\cup}{\Psi\Psi}(\lambda,\ \varepsilon_2)}}$ **is strongly coherent via „∪“. As a result,** $\boxed{St \equiv \underset{\rightarrow\leftarrow}{\underset{\cup}{\Psi\Psi}} \text{ is a high-magnitude force}}$ **.**

VIII.1.3.

The electromagnetic interaction $\textcircled{\gamma} \equiv \textcircled{\overline{\Psi}\Psi}$ has "default" coherency between its internal base spinors $\underset{\rightarrow\leftarrow}{\textcircled{\overline{\Psi}\Psi}}$, from its "normal" $\textcircled{\gamma} \equiv \overline{\Psi}\Psi(-\varepsilon_7)$. As a result, $\textcircled{\gamma} \equiv \textcircled{\overline{\Psi}\Psi}$ is a force of "normal" (average) magnitude. (Ideally, this magnitude should be normalised to 1.)

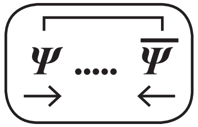
VIII.1.4.

The weak interaction $\textcircled{Z} \equiv$



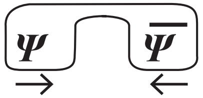
has **durch die indirekte Struktur** **(**

) **only indirect coherency**



, between its internal base spinors, and as a result

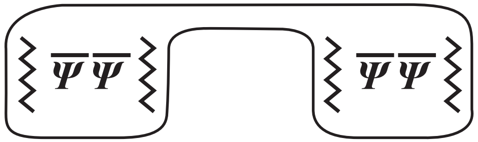
$\textcircled{Z} \equiv$



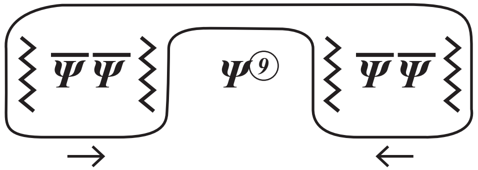
is a low-magnitude force.

VIII.1.5.

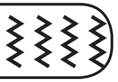
Gravitation $\textcircled{G} \equiv$



, due to its extremely indirect structure and 4 inherent, fundamental separating elements



and 4 inherent, fundamental separating elements

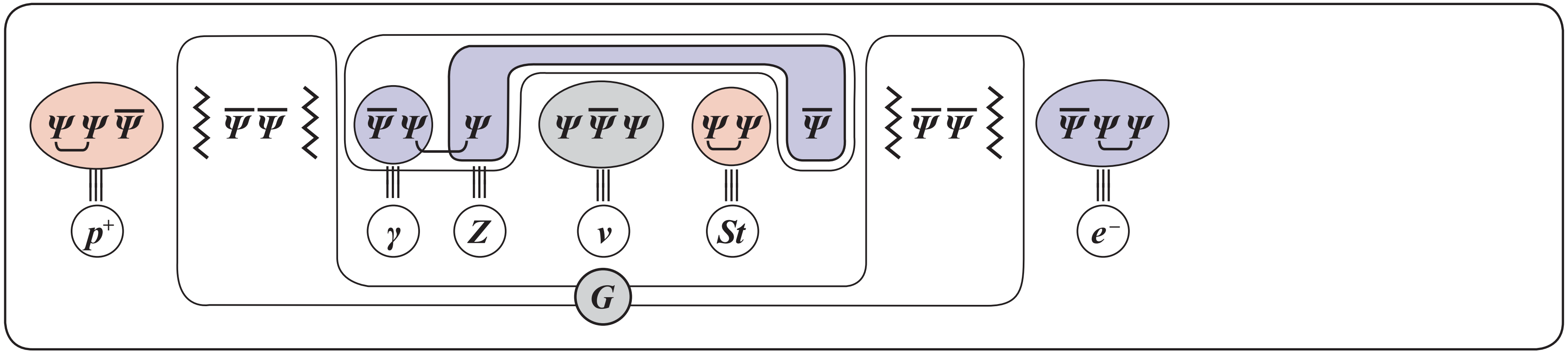


, only has extremely indirect coherency between its internal base spinors. As a result, G is an extremely weak force.

Chapter VIII.2. The chain of events in the creation of individual elementary particles and forces

The final result of the chain of creation processes described in Chapters I. through VII. is shown below:

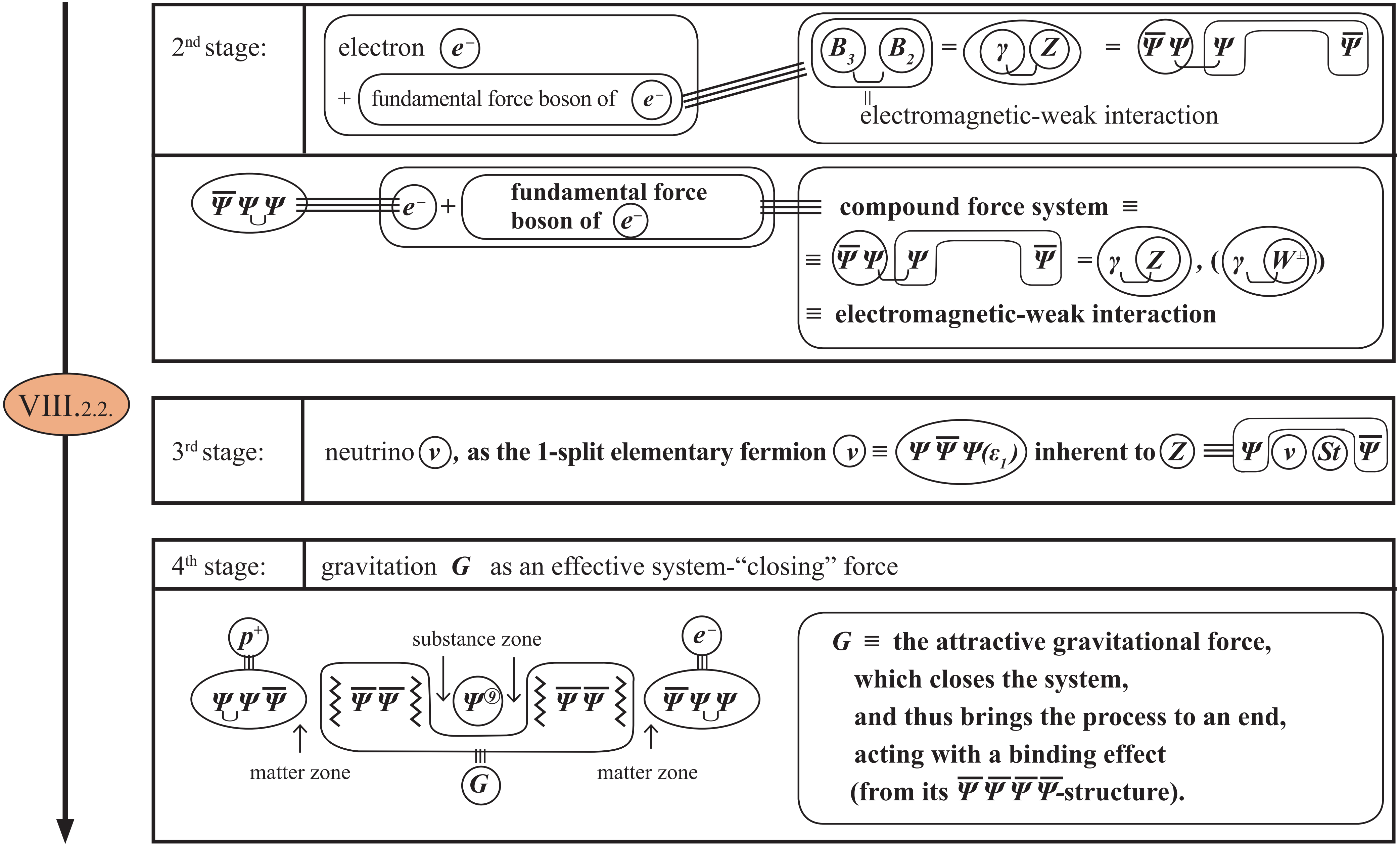
VIII.2.1.



Systemically, these processes are organised into the following order:

VIII.2.2.

1st stage	Proton p^+ + the fundamental force boson of p^+, which is $B_1 \equiv St \equiv \underset{\cup}{\Psi\Psi} \equiv$ strong interaction
$\underset{\cup}{\Psi\Psi}\overline{\Psi} \equiv p^+$ + **fundamental force boson of** $p^+ \equiv B_1 \equiv \underset{\cup}{\Psi\Psi} \equiv St \equiv$ **strong interaction**	



2nd stage:

electron e^-

+ fundamental force boson of e^-

B_3 B_2 = γ Z = $\overline{\Psi}\Psi$ Ψ $\overline{\Psi}$

||

electromagnetic-weak interaction

$\overline{\Psi}\Psi\Psi$ ≡ e^- + **fundamental force boson of** e^- ≡ **compound force system** ≡

≡ $\overline{\Psi}\Psi$ Ψ $\overline{\Psi}$ = γ Z, (γ $W^\pm$)

≡ **electromagnetic-weak interaction**

3rd stage:

neutrino ν, **as the 1-split elementary fermion** ν ≡ $\Psi\overline{\Psi}\Psi(\varepsilon_1)$ **inherent to** Z ≡ Ψ ν St $\overline{\Psi}$

4th stage:

gravitation ***G*** as an effective system-“closing” force

G **≡ the attractive gravitational force,**
which closes the system,
and thus brings the process to an end,
acting with a binding effect
(from its $\overline{\Psi}\overline{\Psi}\overline{\Psi}\overline{\Psi}$-structure).

This sequence of processes fully determines the force structure of the elementary fermions ν, p^+, e^- :

1. **The fundamental force of the proton p^+ is (see Chapter VII.), the strong interaction $\underset{\cup}{\Psi\Psi} = B_1$.**

As p^+ is created before e^- (see Chapter VII.), so that p^+ is already present when e^- and its fundamental force are created, p^+ automatically interacts with the fundamental force of e^- (created later).

2. **The electron e^- is created at a later point in the elementary particle creation process than $p^+ + B_1$ (see Chapter VII.). Thus: the electron e^- cannot interact with the fundamental force of p^+ , and so does not participate in the strong interaction, as the strong interaction B_1 already exists when e^- is created, and the creation structure of e^- therefore already accounts for p^+ and its fundamental force.**

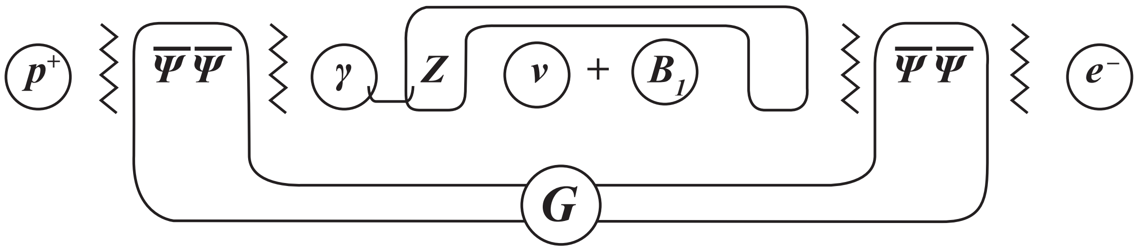
Thus: e^- has its own fundamental force, which is $\gamma \smile Z$ (see Chapter VII.)

3. **Given that the neutrino ν is a fermion created in the interaction zone Ψ⑨**

**it cannot participate in any sort of interaction except for the weak interaction $Z, W^{\pm}$ ν St ,
which inherently incorporates the neutrino (see Chapter VII.).
Thus, the ν is actually the fermionic component of the weak interaction.**

4. **Once the chain of processes** $\xrightarrow{\quad}$ ν, p^{+}, ($B_1 = St$), e^{-}, (γ $Z(W^{\pm})$) **has run its course,**

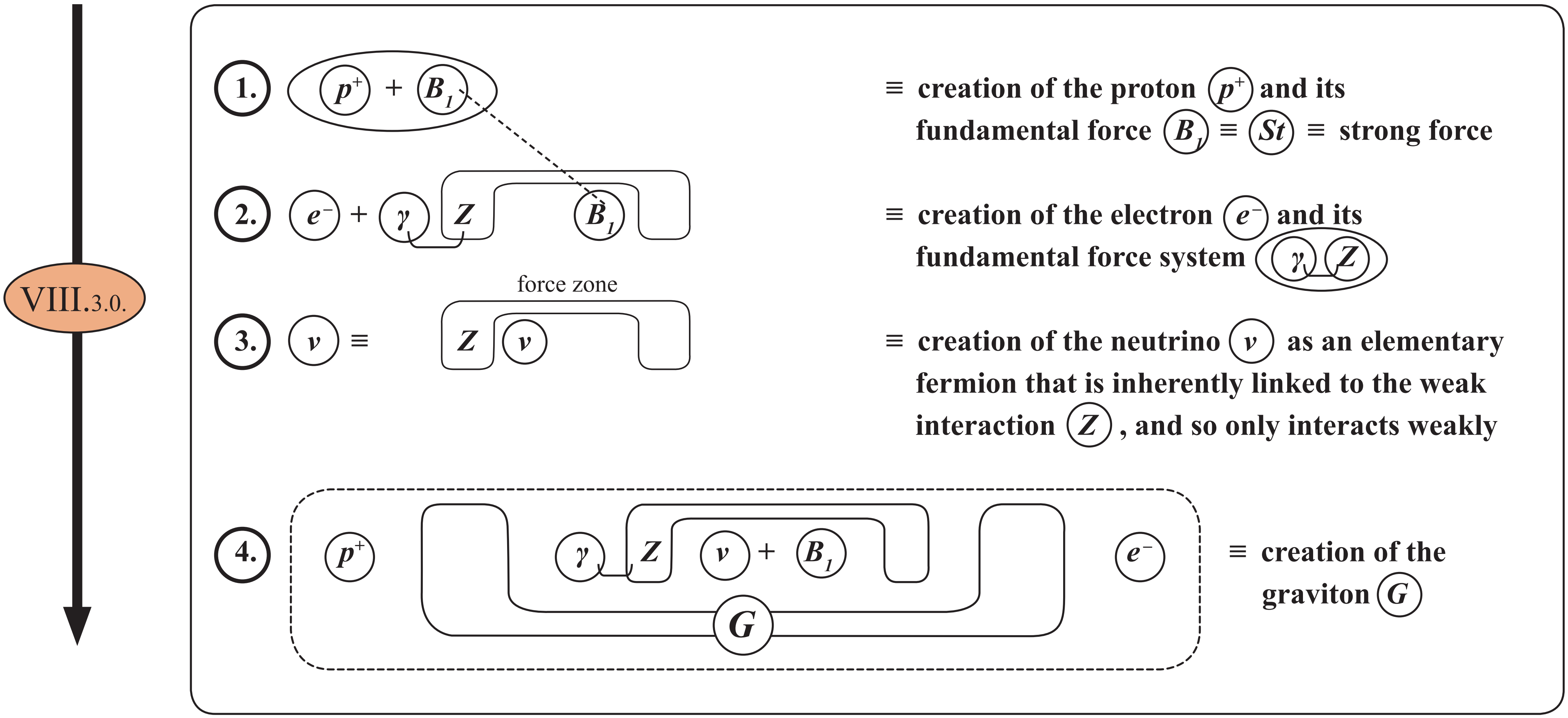
the system-closing force G is formed:



Thus: p^{+} and e^{-} also mutually interact through gravitation G (see Chapter VII.).

Chapter VIII.3. The systemic relation between matter and forces

From VIII.2.2.1. and VIII.2.2.2. the sequence of back-to-back processes occurring within the overall system can be represented as follows:



≡ creation of the proton p^+ and its fundamental force B_1 ≡ St ≡ strong force

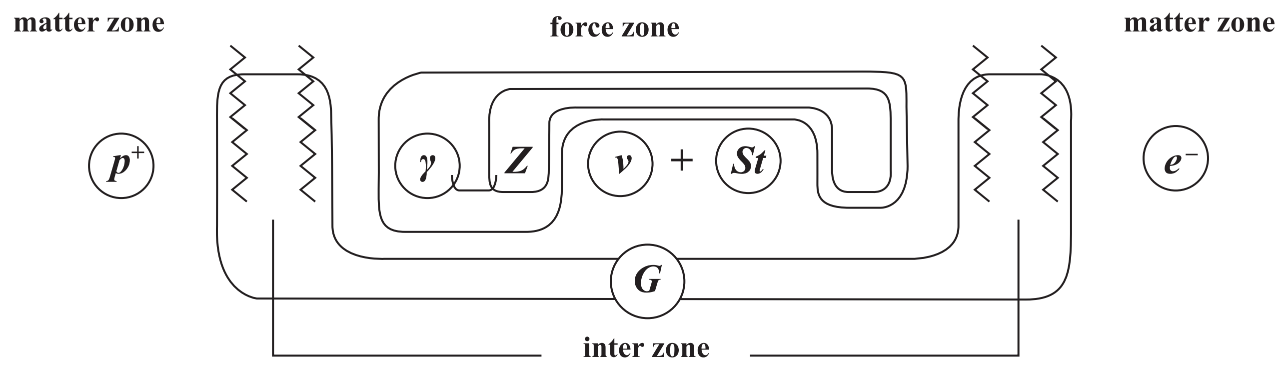
≡ creation of the electron e^- and its fundamental force system γ Z

≡ creation of the neutrino ν as an elementary fermion that is inherently linked to the weak interaction Z, and so only interacts weakly

≡ creation of the graviton G

The overall structure is then as follows:

VIII.3.1.



VIII.3.2.

Thus, there arises from the sequence of processes VIII.2.2.: ①, ②, ③, ④ a systemic relation between elementary particles and elementary forces:

Elementary fermion	Type of interaction			
	strong	electromagnetic	weak	gravitational
Proton p^+	yes	yes	yes	yes
Electron e^-	no	yes	yes	yes
Neutrino ν	no	no	yes	no

with the magnitudes recordd in VIII.1. .

From which follows:

Overall force structure

VIII.3.3.

All of the individual interactions (strong, electromagnetic-weak, gravitational) are systemically interrelated. In other words, the "great unification" of strong and electromagnetic-weak interactions, and the even "greater unification" of strong, electromagnetic-weak and gravitational interactions is system-intrinsic and possesses well-defined structure.

The individual components and the system as a whole are presented in Chapter VII.

Chapter VIII.4. The causality of interaction

These system-wide relationships naturally give rise to the question of causality in elementary particle creation. In VIII.2., the order of the different elementary particle/elementary force creation processes is described. This structured sequence of processes provides causal structure to the creation of elementary particles and elementary forces, making causality itself a fundamental component of the whole process. The concept of causality has been under discussion for decades (since quantization was first discovered, so for more than a century), so the analysis of the causality structure of this sequence of processes and subsequent comparison with conventional, well-known ideas about causality will take place in a dedicated project.

Chapter VIII.5. The creation of the universal constant *c* (≡ speed of light) and the creation of relativity

The structure of the process chain VII.2.2., systemically determines the universal constant *c* and “relativity” in the elementary process, as follows:

The universal constant *c* (speed of light) and relativistic structure arise from the temporal succession of events in the creation process : first the proton p^+, ⟶ and then the electron e^- (see VII.)

In Chapter VII. it was shown in detail that:

first the 4-split elementary fermion with an unresolved ($-\eta$)-dependency $F_1 \equiv p^+$,

the proton $p^+ = p^+(\underbrace{\xi, \varrho, \varepsilon_9, \varepsilon_8}_{};-\eta)$ is created together with its fundamental force $B_1 \equiv \Psi\underset{\cup}{}\Psi(\lambda, \varepsilon_8)$ and

only then – triggered by the creation process $\boxed{p^+;\eta + B_1 \equiv \Psi\underset{\cup}{}\Psi}$, but occurring at later point in the creation sequence – the elementary fermion $F_2(+\eta, \varepsilon_4, \varepsilon_5; \cancel{\xi}, \cancel{\lambda})$ is generated as a 3-split fermion $\equiv$ e^-.

Which means: only once the η-split has been consumed by the creation of the electron e^- is $p^+ = p^+, -\eta$ established as p^+. So: $p^+(\underbrace{\xi, \varrho, \varepsilon_9, \varepsilon_8}_{};-\eta)$ and $e^-(\underbrace{+\eta, \varepsilon_4, \varepsilon_5}_{})$ are linked at creation through the consumption of the η-split caused by the creation of e^-.

This link through the η-split, within the context of the η-dependent sequence of processes VII.18.,

where the η-point split is distributed as $p^+ = p^+(-\eta, ...)$ and $e^- = e^-(+\eta, ...)$,

means that p^+ forms as $p^+(-\eta, ...)$ and e^- forms as $e^-(+\eta, ...)$.

In Chapter II., it was explained how the space-time structure can be derived from the fundamental split $(\xi, \varrho, \lambda; \eta)$ (see II.2.) where (ξ, ϱ, λ) span the spatial component, and the η-split spans time.

This means that when the electron $e^-(+\eta, \varepsilon_4, \varepsilon_5)$ forms in the elementary particle creation process,

the proton $p^+(\xi, \varrho, \varepsilon_9, \varepsilon_8; -\eta)$ has already formed, as $+\eta$ is after $-\eta$ in the time-direction ($\eta \equiv$ time).

As a result of this η-dependency (≡ time-dependency):

VIII.5.1. First, the proton p^+ is generated together with its force boson $B_1 \equiv St$, and only once that is complete does the electron e^- form, together with its own compound force system $\gamma\, Z$.

VIII.5.2. **This relation of structural dependency and the back-to-back physical creation p^+ and e^- justifies the claim that there necessarily exists a type of relativity that is fundamentally grounded in the creation process, and so justifies the existence of the universal constant *c* (speed of light), which actually corresponds to the speed at which this process unfolds:**

$$\text{First} \xrightarrow{c} \text{Then}$$

Physically, this means that: *c* is the structure constant of process succession in the elementary creation process of both of the fundamental matter particles, the proton and the electron:

$$\boxed{\begin{array}{c} p^+ \text{ and } e^- \\ \text{First} \xrightarrow{c} \text{Then} \end{array}}$$

VIII.5.3. **This process is a fundamental creation process, during which nothing else exists except the process itself, namely**

$$\text{First } p^+ \longrightarrow \text{Then } e^- \qquad \text{Thus: This First } p^+ \xrightarrow{c} \text{Then } e^- \text{ is universal.}$$

Thus: *c* is a universal constant (in the exact same way as $\hbar$), see II.5. and II.5.1.).

VIII.5.4 **So: the universal constant *c* is justified by and originates from the fundamental, intrinsic inertia of the process pattern VIII.5.3. : First p^+ ⟶ Then e^- , as**

$$\begin{tikzcd} -\eta \arrow[r] \arrow[r, bend right, no head] & +\eta \end{tikzcd}, \quad \eta \equiv \text{time}.$$

In other words: the fact that time exists gives rise to the universal constant *c*. The origin of the existence of the speed of light *c* is the process sequence VIII.5.3. in the fundamental creation process of matter. This sequence corresponds to the relativistic structure of the fundamentally embedded process inertia.

Chapter VIII.6.
The heavy strong boson, quantitative generation of mass for elementary particles

From VI.3.2. the mass of “elementary particles with split density ≥ 2” is generated from the spinor interaction that occurs between the internal base spinors of each elementary particle. The value of the mass of an elementary particle becomes quantitatively higher as the split density of the internal base spinors increases. The magnitude of the split collision between the interacting internal base spinors depends on 2 other parameters:

a) **Criterion I.**: Elementary particles are distinguished based on whether they contain 2 base spinors (bosons), 3 base spinors (fermions) or 4 base spinors (gravitons).

VIII.6.1.

I.a: The elementary particles with 2 internal base spinors are:

strong boson ≡ St ≡ $\boxed{\Psi\Psi\,(\lambda, \varepsilon_2)}$ see VII.12.

weak boson ≡ $Z(W^{\pm})$ ≡ $\boxed{\Psi \quad \bar{\Psi}\,(\varepsilon_3, \varepsilon_6)}$ see VII.33.

electromagnetic boson ≡ γ ≡ $\boxed{\bar{\Psi}\Psi\,(\varepsilon_7)}$ see VII.33.

VIII.6.2.

I.b : **The elementary particles with 3 internal base spinors are:**

Proton ≡ p^+ ≡ $\boxed{(\underset{\cup}{\Psi\Psi}\overline{\Psi})\,(\xi, \varrho, \varepsilon_9, \varepsilon_8)}$ **see VII.3.**

Electron ≡ e^- ≡ $\boxed{(\overline{\Psi}\underset{\cup}{\Psi\Psi})\,(\eta, \varepsilon_4, \varepsilon_5)}$ **see VII.14.**

Neutrino ≡ ν ≡ $\boxed{(\Psi\overline{\Psi}\Psi)\,(\varepsilon_1)}$ **see VII.1.**

VIII.6.3.

I.c : **The elementary particle with 4 internal base spinors is:**

Graviton ≡ G ≡ $\boxed{(\wr\,\overline{\Psi}\,\overline{\Psi}\,\wr\;\wr\,\overline{\Psi}\,\overline{\Psi}\,\wr)\,(0)}$ **see VII.44.**

if $\gamma = \gamma\ (\varepsilon_7)$ **(see VIII.6.1.), but where either:** $\boxed{G = G\ (0) \text{ and } \gamma\ (\varepsilon_7)}$ **or** $\boxed{G = G\ (-\varepsilon_7) \text{ and } \gamma = \gamma\ (0)}$ **both technically admissible split structures, although in either case,** G **and** γ **both have mass 0 as either 1-split or 0-split particles (see VII.46.)**

Among the 3-spinor elementary particles, the fermions p^+, e^-, ν, **and in this case also among the fermions with split density ≥ 2,** p^+ **and** e^-, **the split collision is distributed over 3 base "parts",** $(\Psi\Psi\overline{\Psi})$ **or** $(\overline{\Psi}\Psi\Psi)$. **This extension to cover 3 base parts allows for more "manoeuvring room", which explains why the split density is lower than for the 2-spinor elementary particle (boson), for which the split collision is concentrated over only 2 base parts.**

It follows that:

VIII.6.4.

Among the bosons (2-spinor elementary particles) with split density ≥2, $Z, W^{\pm}$ and St there is a higher split collision density than for the fermions (3-spinor elementary particles) with split density ≥ 2 , p^{+} and e^{-})

This in turn means that:

VIII.6.5.

The bosons $Z, W^{\pm}$, St have comparatively high mass, but the fermions p^{+}, e^{-} do not.

VIII.6.6.

Thus, for example, the 2-spinor boson Z ≡ $\overbrace{\Psi \qquad \Psi}\ (\varepsilon_6, \varepsilon_3)$ has a mass ~ 90 times higher than the 3-spinor fermion p^{+} ≡ $\underset{\cup}{\Psi\Psi}\overline{\Psi}\ (\xi, \varrho, \varepsilon_9, \varepsilon_8)$, at ~ 90 GeV

b.) Criterion II.: Inner coherency of the internal base spinors of each elementary particle ("inner spinor coherency")

For the *Z*-boson, it holds that (see VI.35.): Z ≡ $\overbrace{\Psi \ \ldots\ldots\ \overline{\Psi}}\ (\varepsilon_6, \varepsilon_3)$, so Z only has indirect coherency between its internal spinors because of the internal $\overbrace{\ldots\ldots}$ -structure.

This indirectness functionally results in a weakened coherency between the internal base spinors $\overbrace{\Psi \qquad \overline{\Psi}}$. See also the chapter on "force magnitudes", VI.35. .

In contrast, the strong scalar boson $\textcircled{St} \equiv \boxed{\underset{\cup}{\Psi\Psi}\,(\lambda, \textcircled{\varepsilon_2})}$ (see also VII.12.) has $\boxed{\text{inner coherency}}$ between its internal base spinors that is orders of magnitude stronger, due to the presence of the fundamental structural binding component „$\cup$“ which in turn creates

- a force that is orders of magnitude stronger than the Z-boson

- and a more concentrated $\boxed{\text{split collision}}$ of its internal base spinors $\boxed{\underset{\cup}{\Psi\Psi}\,(\lambda, \textcircled{\varepsilon_2})}$ from its splits $(\lambda, \textcircled{\varepsilon_2})$ where $\boxed{\lambda \longrightarrow 0,\ \varepsilon_2 \longrightarrow 0}$, caused by the structural binding „$\cup$“ .

Which means:

VIII.6.7.

The strong, scalar boson $\textcircled{St} \equiv \boxed{\underset{\cup}{\Psi\Psi}\,(\lambda, \textcircled{\varepsilon_2})}$ is heavier than the weak boson $\textcircled{Z}(\varepsilon_6, \varepsilon_3) \equiv \boxed{\overline{\Psi \;\ldots\ldots\; \Psi}\;(\varepsilon_6, \varepsilon_3)}$, due to an increased collision density of its internal base spinors relative to the point splits $(\lambda, \textcircled{\varepsilon_2})$

The mass of the weak boson $\textcircled{Z}$ is experimentally known, and is roughly ~ 90 GeV.

Thus, it holds that, from VIII.6.7. , the $\boxed{\text{mass of the strong, scalar boson } \boxed{\underset{\cup}{\Psi\Psi}\,(\lambda, \textcircled{\varepsilon_2})} \text{ must be > 90 GeV.}}$

This may in fact agree with an actual experimental result at Cern, which suggests that there exists a scalar particle with high mass:

(in my opinion, this is the scalar, strong boson particle $\boxed{\underset{\cup}{\Psi\,\Psi}\,(\lambda,\varepsilon_2)}$ which fulfils the roles described in VII. and esp. VII.12. during elementary particle creation)

In the present theory, as described in Chapter VI.3. (esp. VI.3.2. to VI.3.5.) mass is generated by point split collisions of the internal base spinors within each elementary particle, whenever the point split density is ≥ 2.

In the experiments recently conducted at Cern, it was observed that there – very probably – exists a scalar, extremely heavy (approx. 125 GeV) particle, which the majority of physicists suspect is – probably – the particle commonly known as the "Higgs particle". For several decades, this particle served the function of mass-carrier for elementary particles in multiple theories.

However, in the present theory, as described in chapter VI.3. (esp. VI.3.2. to VI.3.5.) the mass ($m \neq 0$) of elementary particles arises from point split collisions of the internal base spinors within each elementary particle – whenever their point split density is ≥ 2. In light of this – if in fact the Higgs field does in fact exist – the causality between mass generation and Higgs field would be the other way around from what is usually assumed:

- Instead of a theory in which the Higgs field is spontaneously present in the elementary particle creation process, for whatever reason (wherever it may come from) which
  - does confer a variable mass m $\neq$ 0 to certain elementary particles (such as for example the proton p^+, the electron e^-, the Z-boson)
  - but does not confer mass (m = 0), to certain other elementary particles (such as the neutrino ν, the photon γ, and the graviton G responsible for gravitation), which therefore remain massless despite the presence of a Higgs field.
- the other way around would be correct:

  Through the primary act of generating a point split density ≥ 2 between the internal base spinors of an elementary particle, an external, secondary field is emitted, which can be used to model mass arising from the primary act of split collisions.

  The external, secondary field generated in this way would thus possess the structural, external properties of a "Higgs field", meaning that it would be highly massive, scalar and consequently detectable.

The mechanism might, however, be completely different: in the present theory, there exists the scalar,

2-split boson $\underset{\cup}{\Psi\,\Psi}(\lambda, \varepsilon_2)$, which, from VII.6., VII.10., VII.11., VII.12.,

- on the one hand mediates the proton's fundamental force,
- and on the other can be identified as the force boson of the strong interaction.

It follows that: The force boson of the strong interaction $\boxed{St} \equiv \boxed{\Psi \underset{\cup}{\,} \Psi}\,(\lambda, \boxed{\varepsilon_2})$

- is: as a 2-point split-object, from VI.32., a massive (mass ≠ 0) and hence short-ranged particle
- is: as a $\boxed{\Psi \underset{\cup}{\,} \Psi}$-object, a scalar particle
- has: due to the fundamental structural binding component „ ∪“ (see VIII.6.7.) a high collision density among its internal base spinors $\boxed{\Psi \underset{\cup}{\,} \Psi}$, which means it must have a higher mass than the weak $\boxed{Z} \equiv \boxed{\overline{\Psi \,\ldots\ldots\, \bar{\Psi}}}$-boson.

Or, expressed the other way around: the Z-boson has lower coherency due to its indirect, internal $\boxed{\overline{\Psi \,\ldots\ldots\, \bar{\Psi}}}$-structure, which causes it to have a lower collision density among its internal base spinors, and therefore a lower mass than the strong boson $\boxed{St} \equiv \boxed{\Psi \underset{\cup}{\,} \Psi}$, precisely because the strong boson $\boxed{St} \equiv \boxed{\Psi \underset{\cup}{\,} \Psi}$ has stronger coherency among its base spinors originating from the presence of the structural binding element „ ∪“, consequently causing it to have a higher mass than the Z-boson.

We now know that the mass of the Z-boson has been measured experimentally to be ~ 90 GeV. Thus, the heavier, strong boson $\boxed{St}$ must have mass > 90 GeV. All of this supports the idea that the ~ 125 GeV heavy, scalar object that was recently observed in the experiments taking place at Cern corresponds to the boson of the strong interaction.

Therefore: Higgs particles (and the Higgs mechanism in general) is not necessary in the present theory, as mass is generated from point split collisions between the internal base spinors present within each elementary particle, as described in VI.32. .

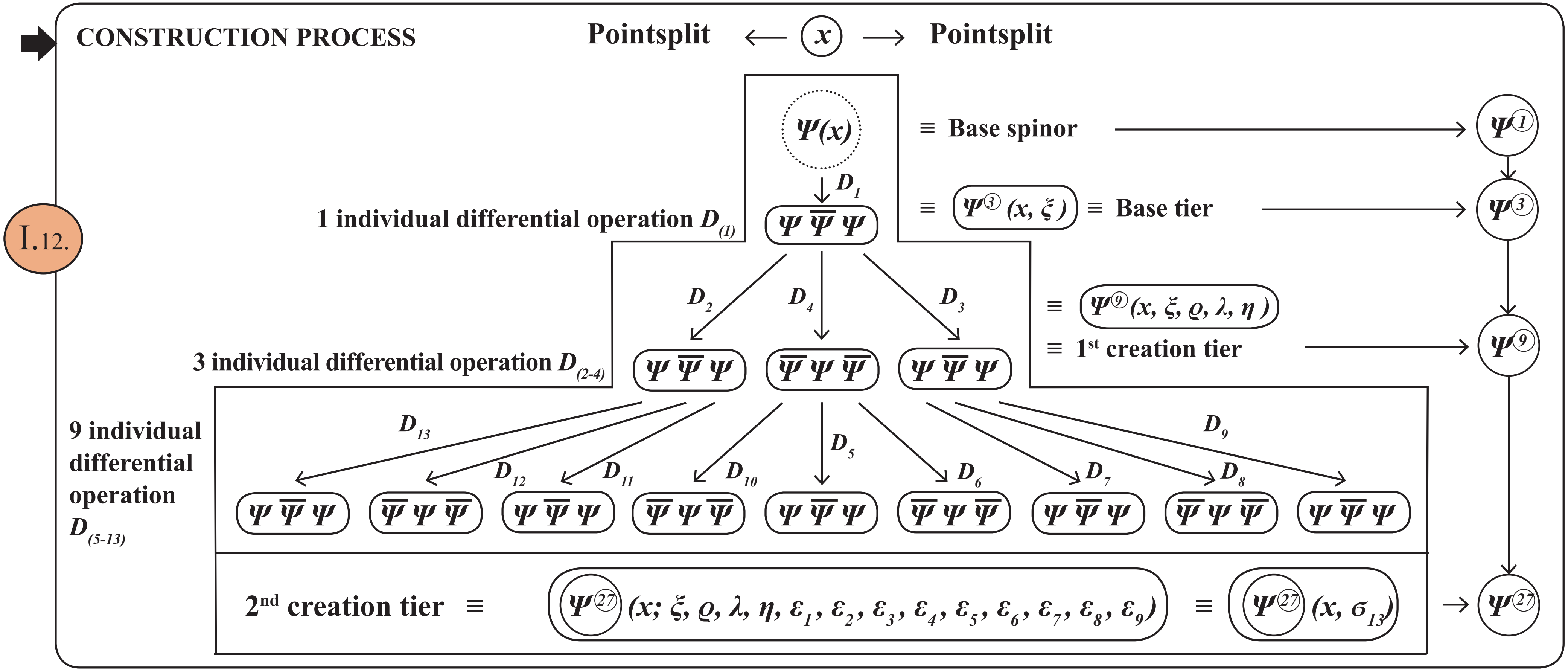
Chapter IX. Overview and statement of completeness of the particle and force structures in the elementary creation process

The elementary particle creation process can be subdivided into 2 fundamental parts:
First, the construction process, and, second, the subsequent structuring and formation process by which all elementary particles are separately generated (see for example VII.66.).

In Chapter I., esp. I.12., it was shown how via 13 different, specific differential operations D^{ν}, $\nu = 1, 2, \ldots 13$) in the split-separated local neighbourhood x,σ_{13}, where $\sigma_{13} \equiv \xi, \eta, \varrho, \lambda, \varepsilon_1, \varepsilon_2, \varepsilon_3, \ldots, \varepsilon_9$, the spinor complex $\Psi^{\textcircled{27}}(x,\sigma_{13})$ is constructed by the fundamental dynamic I.1. and I.2.. The details of the dynamically generated split structure are described in Chapters II., III., esp. III.1., III.2., III.3., and III.4..

The origin of the construction subprocess within the larger context of elementary particle creation can be traced back to the fact that the underlying fundamental dynamic I.1.: $D\Psi = \Psi(x-\sigma)\ \overline{\Psi}(x)\ \Psi(x+\sigma)$, with $\sigma \equiv$ point split with $\sigma \to 0$ contains the differential operator $D = \frac{d}{dx}$, where $dx = \sigma \to 0$. Through the differential term $dx = \sigma$, the pointsplit σ automatically exists, straight from the definitions, implying that “as an equation”, on the right-hand side of the fundamental equation $\Psi(x-\sigma)\ \overline{\Psi}(x)\ \Psi(x+\sigma)$ with $\sigma \equiv$ pointsplit $\to 0$, there must also be a point split σ.

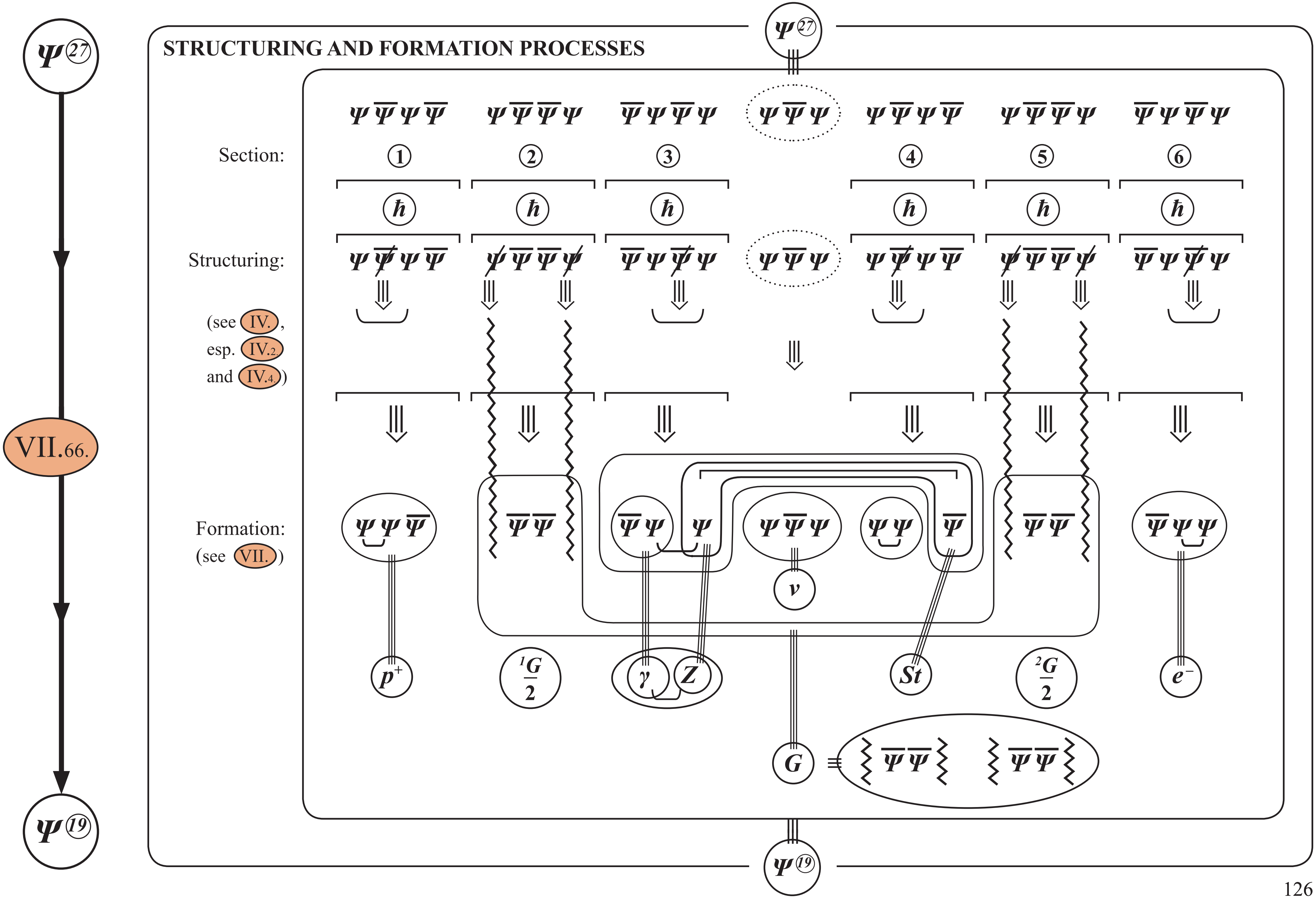
The next page reviews the construction process I.12. and III.4.1, followed by a review of the structuring and formation process VII.6.6.



Considerimg the effective local layout of the split-open 1st creation tier $\Psi^{⑨}(x,\sigma_4)$ as well as the – according to III.1. → III.4. – split-open generated 2nd creation tier $\Psi^{㉗}(x,\sigma_{13})$, the local layout is:

III.4.1. $\Psi^{㉗}$

Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ	Ψ	$\overline{\Psi}$	Ψ	Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ	$\overline{\Psi}$	Ψ
x $-\xi -\varrho$ $-\varepsilon_9$	x $-\xi -\varrho$ 0	x $-\xi -\varrho$ $+\varepsilon_9$	x $-\eta$ $-\varepsilon_8$	x $-\eta$ 0	x $-\eta$ $+\varepsilon_8$	x $-\xi$ $-\varepsilon_7$	x $-\xi$ 0	x $-\xi$ $+\varepsilon_7$	x $-\xi +\varrho$ $-\varepsilon_6$	x $-\xi +\varrho$ 0	x $-\xi +\varrho$ $+\varepsilon_6$	x 0 $-\varepsilon_1$	x 0 0	x 0 $+\varepsilon_1$	x $+\xi -\lambda$ $-\varepsilon_2$	x $+\xi -\lambda$ 0	x $+\xi -\lambda$ $+\varepsilon_2$	x $+\xi$ $-\varepsilon_3$	x $+\xi$ 0	x $+\xi$ $+\varepsilon_3$	x $+\eta$ $-\varepsilon_4$	x $+\eta$ 0	x $+\eta$ $+\varepsilon_4$	x $+\xi +\lambda$ $-\varepsilon_5$	x $+\xi +\lambda$ 0	x $+\xi +\lambda$ $+\varepsilon_5$


Ψ㉗
VII.66.
Ψ⑲
STRUCTURING AND FORMATION PROCESSES
Ψ㉗
Section:
① ② ③ ④ ⑤ ⑥
ħ
Structuring:
(see IV.,
esp. IV.2.
and IV.4.)
Formation:
(see VII.)
ν
p⁺
¹G/2
γ
Z
St
²G/2
e⁻
G
Ψ⑲

After that, all of the elementary particles are individually formed:

VII.70.

Proton:	p^+	$\equiv$	$\underset{\cup}{\Psi}\Psi\bar{\Psi}\ (-\xi, -\varrho, -\varepsilon_8, \boxed{\pm\varepsilon_9})$	$\equiv$	**3-base spinor-4-split-object**	**1 ħ**
Electron:	e^-	$\equiv$	$\bar{\Psi}\Psi\underset{\cup}{\Psi}\ (+\eta, +\varepsilon_4, \boxed{\pm\varepsilon_5})$	$\equiv$	**3-base spinor-3-split-object**	**1 ħ**
Neutrino:	ν	$\equiv$	$\Psi\bar{\Psi}\Psi\ (\boxed{\pm\varepsilon_1})$	$\equiv$	**3-base spinor-1-split-object**	**1 ħ**
Strong interaction:	St	$\equiv$	$\underset{\cup}{\Psi}\Psi\ (-\lambda, \boxed{\pm\varepsilon_2})$	$\equiv$	**2-base spinor-2-split-object**	**1 ħ**
Electromagnetic-weak interaction:	$\gamma\ Z$	$\equiv$	$\boxed{\bar{\Psi}\Psi}\ \boxed{\overbrace{\Psi\qquad\bar{\Psi}}}\ (-\varepsilon_3, \boxed{\pm\varepsilon_6}, +\varepsilon_7)$	,		**1 ħ**

with the following two distinct components, coupled together by „ ∪”, but still independently existing (see VII.23. to VII.33.)

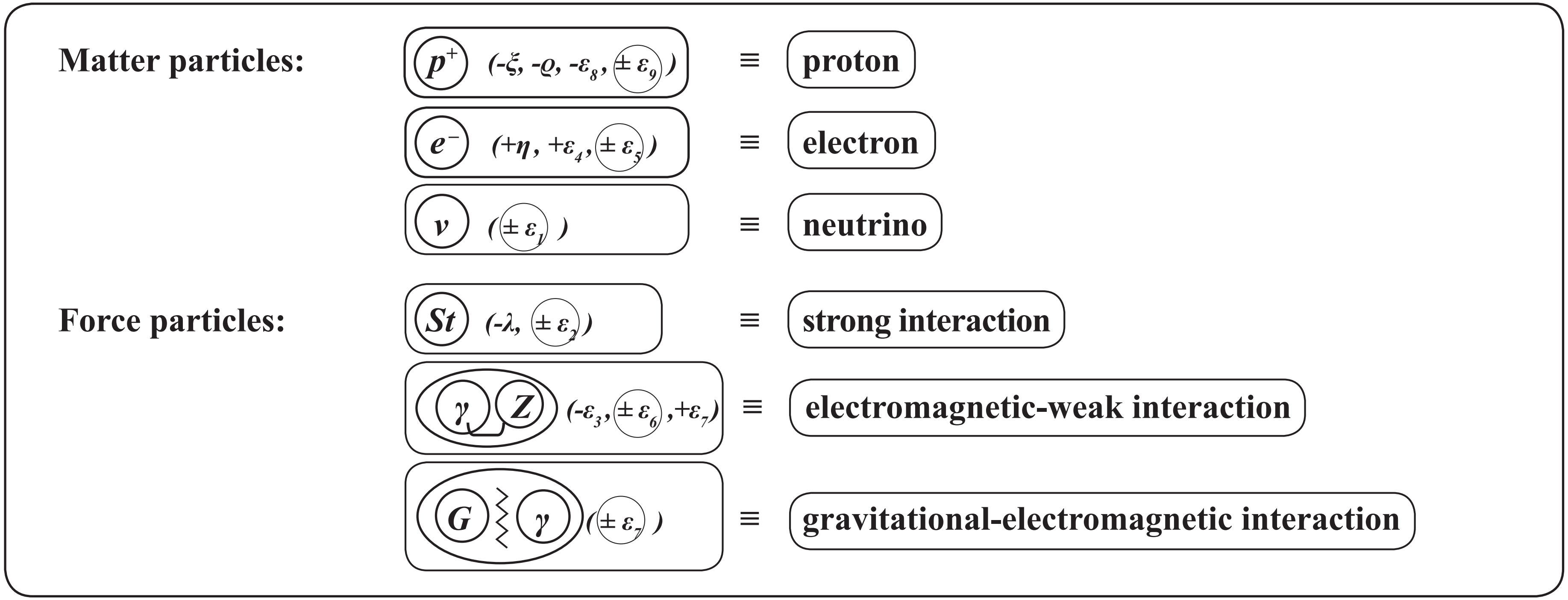
	Z	$\equiv$	$\overbrace{\Psi\ \ldots\ \bar{\Psi}}\ (+\varepsilon_6, -\varepsilon_3)$	$\equiv$	**2-base spinor-2-split-object**	
	γ	$\equiv$	$\boxed{\bar{\Psi}\Psi}\ (+\varepsilon_7)$	$\equiv$	**2-base spinor-1/0-split-object**	
Gravitational interaction:	G	$\equiv$	$\wr\,\bar{\Psi}\bar{\Psi}\,\wr\quad\wr\,\bar{\Psi}\bar{\Psi}\,\wr\ (-\varepsilon_7)$	$\equiv$	**4-base spinor-0/1-split-object,**	**1 ħ**

with γ / G association, see VII.46.

Subsequently, the properties characteristic to each elementary particle are formed:
The properties of each individual elementary particle, such as mass, charge, the forces with which it interacts, the magnitudes of these forces… are established from the point split structure (and the split collision density resulting therefrom) of their internal base spinors, and from the inner spinor coherency (VIII.6.) of these spinors. This process is described in full detail in Chapter VII., VIII. .
Furthermore, considering the point split structure of the system as a whole, there is a relation between the electromagnetic interaction and gravitation, as described in VII.79. :

The ⑥ fundamentally arising particles – from the 6-quanta structure VII.60. – are (see VII.77. and VII.78.):

VII.79.



Matter particles:
p^+ $(-\xi, -\varrho, -\varepsilon_8, \pm\varepsilon_9)$ ≡ **proton**
e^- $(+\eta, +\varepsilon_4, \pm\varepsilon_5)$ ≡ **electron**
v $(\pm\varepsilon_1)$ ≡ **neutrino**

Force particles:
St $(-\lambda, \pm\varepsilon_2)$ ≡ **strong interaction**
γ Z $(-\varepsilon_3, \pm\varepsilon_6, +\varepsilon_7)$ ≡ **electromagnetic-weak interaction**
G γ $(\pm\varepsilon_7)$ ≡ **gravitational-electromagnetic interaction**

In Chapter VIII.2. the sequence of processes responsible for the creation of each individual elementary particle is described, from which a systemic relation between matter and force was derived in Chapter VIII.3., a relation which is coherent with real, experimental results. Namely:

VIII.3.2.

A systemic relationship between elementary particles and elementary forces arises from the process sequence VIII.2.2.: ①, ②, ③, ④, as follows:

Elementary fermions	Type of interaction			
	strong	electromagnetic	weak	gravitational
Proton p^+	yes	yes	yes	yes
Elektron e^-	no	yes	yes	yes
Neutrino v	no	no	yes	no

with the magnitudes recorded in VIII.1. .

From which follows:

Overall force structure

VIII.3.3.

All of the individual interactions (strong, electromagnetic-weak, gravitational) are systemically interrelated. In other words, the "great unification" of strong and electromagnetic-weak interactions, and the even "greater unification" of strong, electromagnetic-weak and gravitational interactions is system-intrinsic and possesses well-defined structure. The individual components and the system as a whole are presented in Chapter VII. .

THE END