

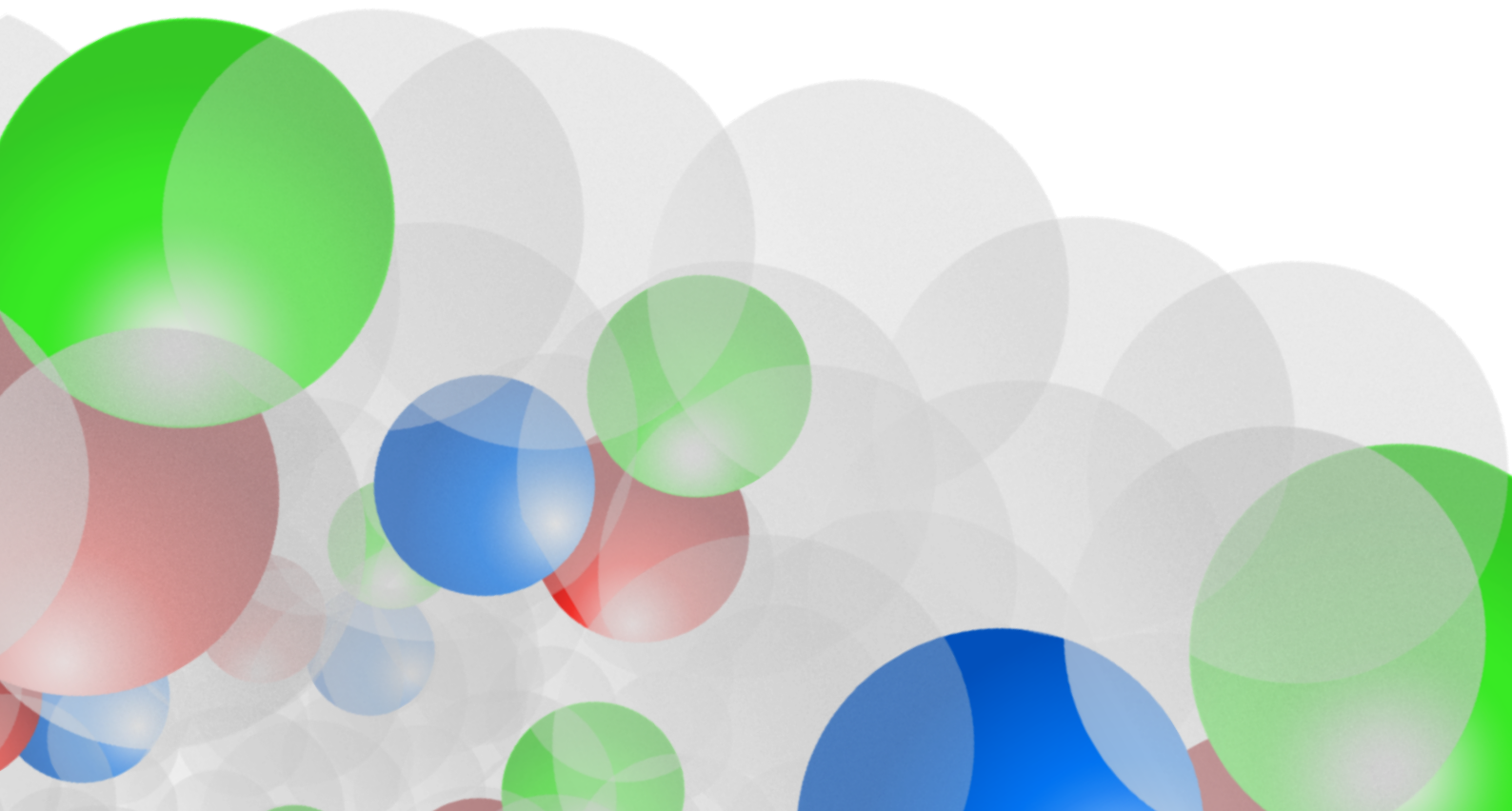
Fractal Quantum Space Model (FQSM)

A Foundational Ontological Model

Part 3 – Oscillation Dynamics, Influence Fields, and Feedback

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Version 1.0



Document history

Version	Date	Author	Contact	Changes
1.0	12 October 26	Frank Hafer	kontakt@akasha-interview.com	Document published.

Required documents

ID	Document	Version	Function
[1]	FQSM-Part-1-en_v1r01.pdf	1.1	The Geometry of Reality
[2]	FQSM-Part-2-en_v1r00.pdf	1.0	Projection Architecture and Dynamics

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Abstract

Part 3 of the Fractal Quantum Space Model (FQSM) describes the fundamental dynamic processes within the quantum spaces that arise from the projection of determinations and the interactions between quantum points. The main focus is on the oscillation states of quantum points, the generation and propagation of frequency bubbles, and the formation of spatially distributed influence fields.

Building on the projection architecture described in Part 2 of the FQSM, this part explains how changes in oscillation states can lead to the generation of frequency bubbles and how frequency-bubble cascades and influence fields can develop from them. When the excitation of a projection pair reaches the stimulation threshold, a manifestation on the material level may emerge.

In addition, Part 3 describes the generation of potential differences through interactions and external energy input, as well as the return of these potential differences via bypasses, opposite to the direction of projection. It examines the different processing methods employed by fundamental projecting quantum points (FPQPs) and manifesting quantum points (MQPs). The combination of projection and feedback establishes a closed control loop through which changes within the quantum spaces can be taken into account in subsequent projections.

Part 3 thus extends the geometric and projective structure described in the first two parts by introducing the fundamental processes governing oscillation dynamics, influence fields, and feedback. The detailed examination of further interactions and binding processes is reserved for subsequent parts of the FQSM.

Notation

The following table extends the definitions of terms provided in Parts 1 and 2 of the FQSM. It serves as an internal notation system for the concise representation of relationships between the model's components.

Definitions of terms

Symbol	Meaning
FB	Frequency Bubble
A_FB	Surface Area of a Frequency Bubble
v_FB	Propagation Speed of a Frequency Bubble in the Primordial Substrate
P_d	Surface Density of the Influence Quantity Conveying Information about the Total Amount of Potential Used by the Generating Quantum Point
P_ges	Total Amount of Potential Used by the Generating Quantum Point at the Time of Emission, Underlying the Oscillation State Represented on the Frequency Bubble
P_ist	Actual Amount of Potential Used by a Quantum Point
P_soll	Target Potential Utilisation Prescribed by the Determination
ΔP	Potential Difference ($P_{ist} - P_{soll}$)
ΔP_{ges}	QS-Specific Total Potential Difference Accumulated by the MQP during Energy Input, Separately for the SL and ML

1. Basic concepts

The following fundamental terms define the core elements of oscillation dynamics and the control loop in the Fractal Quantum Space Model (FQSM). They extend the fundamental terminology introduced in the preceding parts of the FQSM 1 and 2.

1.1. Laws Governing a Quantum Space

The laws governing a quantum space determine how a quantum point processes a projected determination and which processes and manifestations arise as a result within that quantum space.

1.2. Fundamental Oscillation and Carrier Wave

The fundamental oscillation is the oscillation prescribed for a quantum point by its Fundamental Determination. The carrier wave of a quantum space refers to the entirety of the phase-shifted fundamental oscillations of its quantum points and forms their common basis for further oscillation states.

1.3. Oscillation State

The oscillation state describes the current oscillation of a quantum point in the Primordial Substrate. It results from the determination currently in effect and the interactions acting on the quantum point and processed in accordance with the laws governing its quantum space.

1.4. Frequency Bubble (FB)

A frequency bubble is a wavefront that propagates spherically through the Primordial Substrate. It is generated by a quantum point of the Subtle Layer when its oscillation state changes relative to its fundamental oscillation and the condition required for its generation is met.

1.5. Influence Quantity

An influence quantity is a value representing an influence within the FQSM that can cause a change in the oscillation state or potential utilisation of a receiving quantum point. An influence quantity does not itself transfer potential.

1.6. Potential Density

Potential density describes the surface density of the influence quantity that conveys, through a frequency bubble, information about the amount of potential used by the generating quantum point. It determines the possible intensity with which the oscillation information, also represented on the frequency bubble, can act on a receiving quantum point.

1.7. Frequency-Bubble Cascade

A frequency-bubble cascade is the successive generation and propagation of frequency bubbles by excited quantum points, whereby the effect of one frequency bubble can excite further quantum points to generate additional frequency bubbles.

1.8. Influence Field

The influence field denotes the spatial region in which frequency bubbles can act on quantum points within a quantum space and influence their oscillation states.

1.9. Stimulation Threshold

The stimulation threshold denotes the range of potential utilisation of a QP on the SL at or above which the excitation of the coupled QP on the ML can provide the basis for a manifestation.

1.10. Central Quantum Points of the Manifestation

The quantum points of a projection pair temporarily used by an MQP as part of a manifestation are referred to as the central quantum points of the manifestation.

1.11. Potential Difference (ΔP)

The potential difference ΔP denotes the deviation of the actual potential utilisation (P_{ist}) from the target potential utilisation (P_{soll}) prescribed by the determination.

1.12. Bypass

The bypass is the structural return channel of a triadic coupling. It conveys potential differences as influence quantities in stages, opposite to the direction of projection, from the Material Layer through the Subtle Layer to the Quantum Layer.

1.13. Feedback

Feedback denotes the transmission of potential differences to the associated projection pair via the corresponding influence quantities of the determination.

2. The Energetic Foundation of the Quantum Spaces

This chapter describes the frequency ranges of the quantum spaces (QS), as well as the fundamental oscillations and the oscillation processes of quantum points (QP) influenced by projection impulses and interactions.

2.1. Frequency Bands and Carrier Waves

In the FQSM, it is assumed that the Foundational Domain (FD) encompasses a continuous frequency spectrum. The Quantum Layer (QL), the Subtle Layer (SL), and the Material Layer (ML) are assigned to different frequency ranges within this spectrum.

The ML is assigned to the lowest frequency range. The SL lies within a higher frequency range, while the QL encompasses the entire frequency spectrum considered in the FQSM (Figure 1).

The carrier wave provides the basis for the oscillation states within the respective frequency range. If the oscillation state of a QP on the SL changes relative to its fundamental oscillation and the required generation condition is met, a frequency bubble (FB) may arise and propagate through the Primordial Substrate.

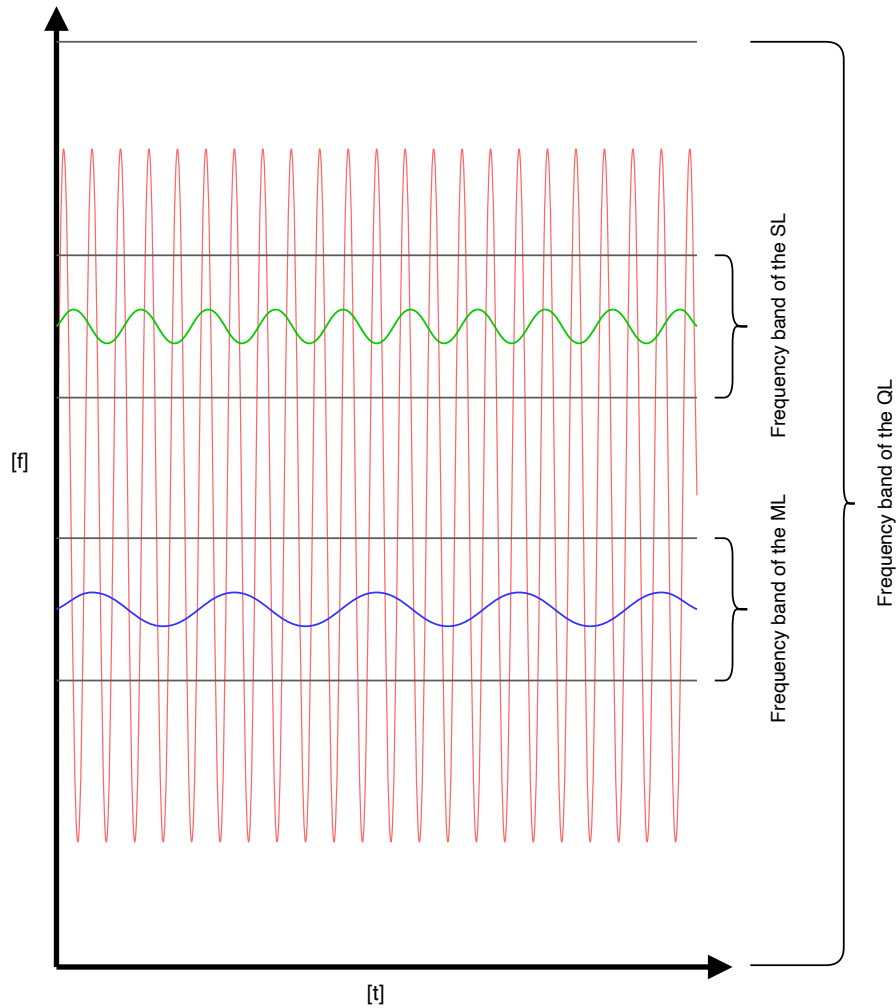


Figure 1: Frequency spectrum of the FD; frequency bands and carrier waves

2.2. Oscillation of Quantum Points within a Quantum Space

Each QP of a QS oscillates in accordance with its Fundamental Determination. This prescribes the QP's fundamental oscillation and the potential utilisation required for it. The fundamental oscillation has a characteristic frequency, which is linked to the potential utilisation of the QP within the FQSM. The specific processes that link potential utilisation and oscillation parameters are not defined in greater detail within the FQSM.

A projection impulse projects the currently applicable determination (DT) onto the QP once again, thereby stimulating its oscillation process. Between projection impulses, the most recently projected DT remains in effect. The resulting oscillation process can continue to change in accordance with the laws governing the QS and the interactions that occur.

The effect of recurring projection impulses can be compared to a lamp switching on periodically. A projection impulse corresponds to the renewed stimulation of the oscillation process. If the next impulse occurs before the oscillation has ceased, the process is stimulated again. The short intervals between projection impulses can thus produce an apparently continuous oscillation process, even though the projection itself consists of discrete projection impulses.

Incoming influence quantities, such as those conveyed by FBs, can be processed by a QP in accordance with the laws governing its QS. Interactions may thereby lead to a change in potential utilisation and, consequently, to a change in the oscillation state. The oscillation state can change within the frequency band applicable to the respective QS. A pure fundamental oscillation does not lead to the generation of a frequency bubble by the QP.

3. Frequency Bubbles: Generation and Propagation

This chapter describes the generation and propagation of frequency bubbles (FBs), their influence quantities, and the decrease in their potential density with increasing distance from the generating quantum point.

3.1. Generation and Influence Quantities of a Frequency Bubble

An FB may arise when the oscillation state of a quantum point (QP) on the Subtle Layer (SL) changes relative to its fundamental oscillation and the condition required for its generation is met.

Quantum points on the SL can be stimulated to increase their potential utilisation by incoming influence quantities or an extended determination (DT). When their potential utilisation reaches the range required for FB generation, they can generate FBs. An FB carries two distinct influence quantities:

- The pattern of the wavefront represents the oscillation state of the generating QP at the time of emission. This information describes the complete oscillation state of the generating QP.
- The second influence quantity conveys information about the amount of potential that the generating QP took from the Primordial Substrate at the time of emission and that underlies the oscillation state represented on the wavefront. Its surface density is referred to as potential density and determines the possible intensity with which this information can act on receiving QPs.

Both influence quantities are processed jointly by a receiving QP. The oscillation information determines which interaction is possible, while the potential density determines the intensity with which this interaction can take effect. Neither influence quantity alone causes a change in the receiving QP.

The FB does not transfer potential to the receiving QP. The potential required to change its oscillation state continues to be obtained from the Primordial Substrate.

3.2. Propagation Speed of a Frequency Bubble

In the FQSM, it is assumed that, within one projection interval, the wavefront of an FB propagates through the Primordial Substrate over a distance equal to d_{QP} , the distance between adjacent QPs on a projection surface. This gives the following propagation speed:

$$v_{FB} = \frac{d_{QP}}{\Delta t}$$

The projection interval corresponds to the reciprocal of the Fundamental Projection Rate:

$$\Delta t = \frac{1}{FPR}$$

With $d_{QP} = lp$, this gives:

$$v_{FB} = lp * FPR$$

Since, in Part 2 of the FQSM, the product $lp * FPR$ was equated with the speed of light in a vacuum, c , it follows that:

$$v_{FB} = c$$

Where:

- v_{FB} denotes the propagation speed of the FB through the Primordial Substrate,
- d_{QP} denotes the distance between two adjacent QPs on a projection surface,
- l_p denotes the Planck length,
- FPR denotes the Fundamental Projection Rate,
- Δt denotes the time interval between two successive projection impulses,
- c denotes the speed of light in a vacuum.

The wavefront of an FB is generated discretely as part of a projection impulse and subsequently propagates continuously through the Primordial Substrate at the speed of light c .

3.3. Potential Density of a Frequency Bubble

An FB is a potential wavefront that propagates spherically through the Primordial Substrate. Two distinct influence quantities are conveyed as information on its surface. The pattern of the wavefront represents the oscillation state of the generating QP at the time of emission. The second influence quantity conveys information about the amount of potential that the generating QP took from the Primordial Substrate at that time and that underlies the oscillation state represented on the wavefront.

This information about the amount of potential used is described by the quantity P_{ges} . As the wavefront expands, the corresponding influence quantity is distributed over an increasingly larger surface area. Potential density, P_d , denotes the density of this influence quantity per unit area. It therefore does not describe the potential amount of the FB itself, but rather the spatial distribution of the information about the amount of potential.

The surface area of a spherical FB at a distance r from the generating QP is given by:

$$A_{FB}(r) = 4 * \pi * r^2$$

The potential density is therefore:

$$P_d(r) = \frac{P_{ges}}{4 * \pi * r^2}$$

Where:

- $P_d(r)$ denotes the surface density of the influence quantity at a distance r from the generating QP,
- P_{ges} denotes the total amount of potential used by the generating QP at the time of emission, about which the second influence quantity conveys information,

- $A_{FB}(r)$ denotes the surface area of the FB at a distance r ,
- r denotes the distance of the wavefront from the generating QP.

The potential density of the represented influence quantity decreases with increasing distance in proportion to $(1/r^2)$. Consequently, a receiving QP has a lower intensity of this influence quantity available to it. It processes this quantity together with the transmitted oscillation information. The potential required for its own processing and possible interactions continues to be obtained from the Primordial Substrate.

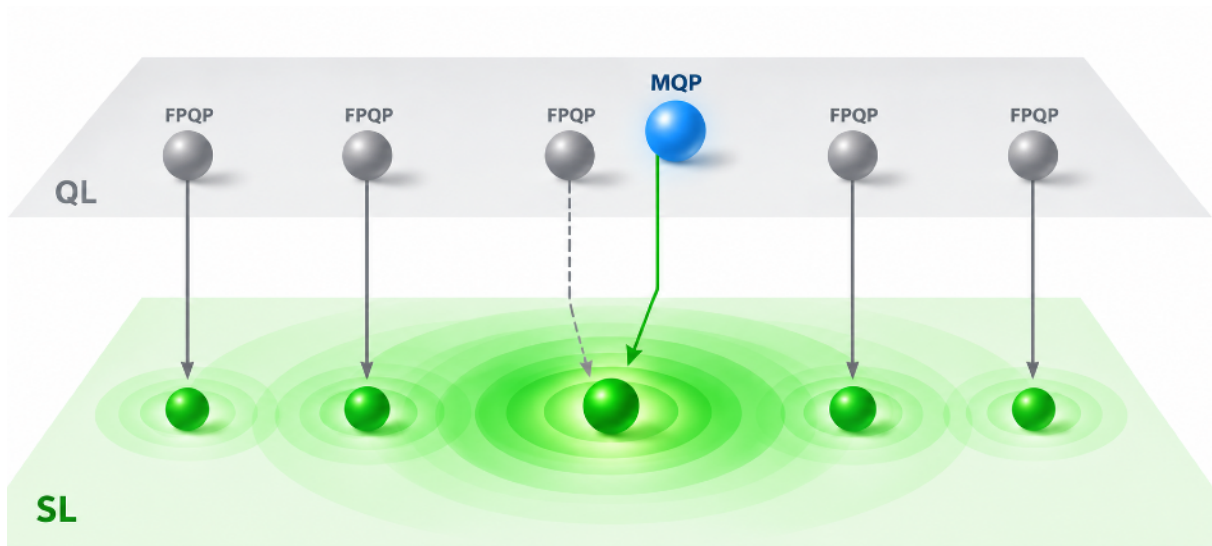


Figure 2: Propagation of an FB Generated by the Central QP on the SL Following Temporary Projection by an MQP

4. Frequency-Bubble Cascades and Influence Fields

This chapter describes how interactions caused by frequency bubbles can trigger the generation of further frequency bubbles and how this can lead to the development of spatially distributed influence fields with varying excitation intensities.

4.1. Generation of a Frequency-Bubble Cascade

When a frequency bubble (FB) reaches a quantum point (QP) on the Subtle Layer (SL), the QP processes the incoming influence quantities in accordance with the laws governing its quantum space (QS). This may change its oscillation state and increase its potential utilisation.

If the potential utilisation reaches the range required for the generation of an FB, the excited QP may itself generate an FB. This FB may excite further QPs and thereby trigger the generation of additional FBs.

The successive generation and propagation of FBs can give rise to a frequency-bubble cascade (FB cascade). The range of an FB cascade depends on the effects of the incoming FBs and the conditions of the respective receiving QPs. Not every excited QP necessarily generates an FB itself.

When several FBs reach a QP simultaneously, their effects are processed jointly with its determination (DT) and its current oscillation state.

4.2. Structure and Spatial Extent of the Influence Field

The effects of FBs are distributed spatially across the affected QPs. The spatial region in which FBs can influence the oscillation states of QPs under the given conditions constitutes the influence field.

As the distance from the generating QP increases, the surface density of the influence quantity represented on the wavefront decreases. This reduces the possible intensity of its effect on receiving QPs. The spatial extent and excitation intensity of the influence field result from the totality of the propagating FBs and the processing conditions of the receiving QPs.

The influence field must not be equated with the range of the FB cascade. QPs that are influenced by incoming FBs without generating further FBs themselves may also exhibit a changed oscillation state and continue to belong to the influence field.

4.3. Stimulation Threshold and Near Field of the Manifestation

As the distance from the generating QP increases, the possible intensity of the FB effect decreases. Consequently, the oscillation states of the affected QPs may change to varying degrees.

The stimulation threshold denotes the range of potential utilisation of a QP on the SL at or above which the excitation of the coupled QP on the ML can provide the basis for a manifestation.

When the threshold is reached, the excitation of the projection pair may lead to the formation of a manifestation on the ML.

The effect of an FB may persist even below this threshold. In such cases, the affected QPs may exhibit oscillation states that differ from their fundamental oscillations, without the excitation of the associated QPs on the ML being sufficient to produce a manifestation. This region is referred to as the near field of the manifestation.

The near field must not be equated with the range of the FB cascade. QPs that do not receive sufficient excitation to generate further FBs may also exhibit a changed oscillation state within the influence field.

The stimulation threshold does not constitute a sharp geometric boundary. Rather, it denotes a dynamic transition region whose position depends on the potential density of the incoming FBs and on the entirety of the interactions acting on the participating QPs.

Figure 3 illustrates the spatial distribution of excitation intensity within an influence field. The inner dashed line schematically indicates the transition region of the stimulation threshold. The region between the two dashed lines represents the near field of the manifestation. The outer dashed line delineates the schematically represented extent of the influence field. The lines do not mark fixed geometric boundaries but serve to illustrate the different excitation regions.

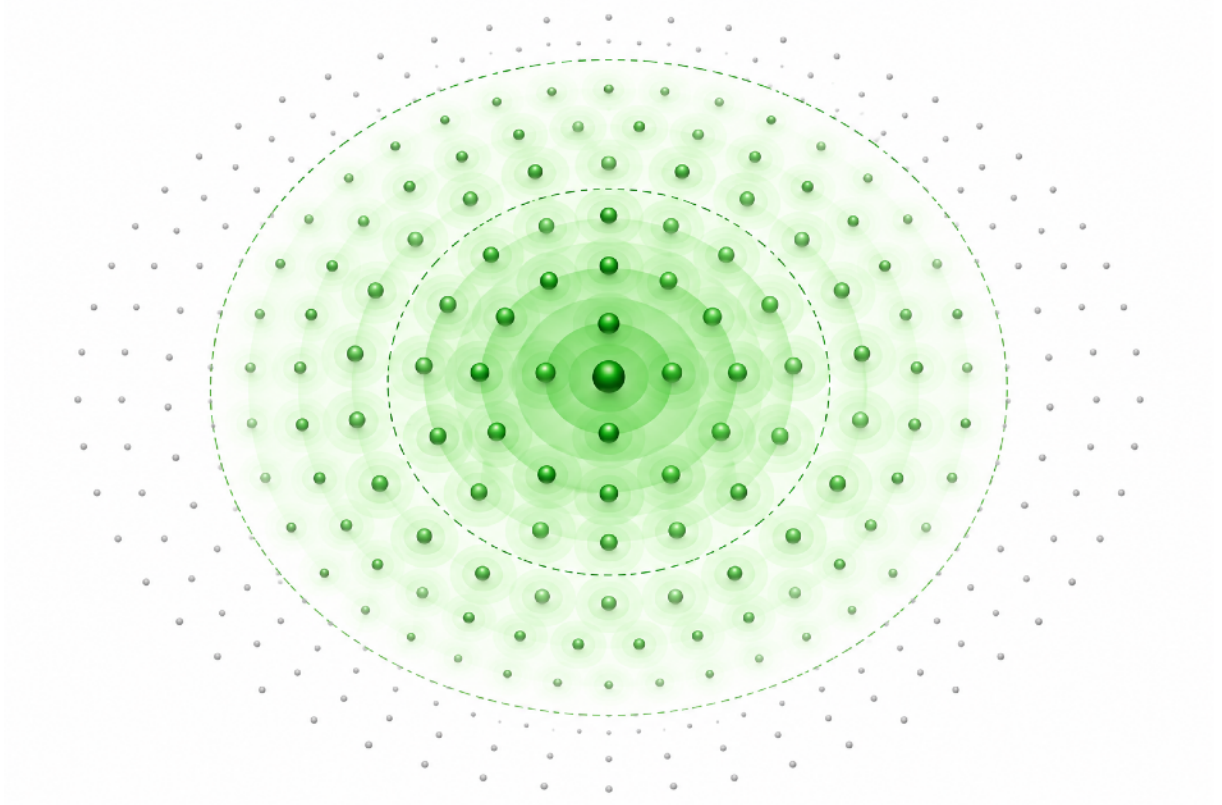


Figure 3: Schematic Representation of the Influence Field of an FB Cascade

5. The Process of Manifestation

This chapter describes how the projection of a determination (DT), the interactions of frequency bubbles (FBs), and the excitation of projection pairs work together to enable a manifestation on the Material Layer (ML).

5.1. Initial Projection and First Frequency Bubble

The manifestation process described here begins with a manifesting quantum point (MQP) on the Quantum Layer (QL). It temporarily utilises the projection coupling of a projection pair assigned to a fundamentally projecting quantum point (FPQP) and transfers its DT to this projection pair.

The central QP on the Subtle Layer (SL) processes the projected DT in accordance with the laws governing its quantum space (QS). This may increase its potential utilisation and change its oscillation state. If the excitation reaches the required condition, the central QP may generate a first FB. This first FB initiates the subsequent dynamics but does not immediately lead to a manifestation on the ML.

5.2. Development of the Influence Field

Starting from the central QP on the SL, the FB cascade described in Chapter 4 may propagate and expand the influence field spatially.

Within the fundamental triadic coupling, the changed oscillation states on the SL may influence the potential utilisation of the corresponding QPs on the ML. The spatial distribution of these interactions forms the basis for the possible formation of a manifestation.

5.3. Reaching the Stimulation Threshold

When the stimulation threshold described in Section 4.3 is reached by a projection pair, the excitation of the associated QP on the ML may provide the basis for a manifestation. Whether a manifestation arises, and in what form, depends on the interactions acting simultaneously within the influence field.

The spatial extent of the manifestation results from the distribution of the changed oscillation states and the interactions of the participating QPs within the influence field. It is therefore not determined by a single FB.

5.4. Central Void in the Manifestation

In the manifestation process described here, the central QP on the ML associated with the MQP does not participate in the manifested structure. The manifestation forms around this central region, creating a void corresponding to the region occupied by this QP.

The spatial assignment of the central QP within the fundamental triadic coupling remains unchanged. It remains part of the coupling structure without becoming part of the manifested structure on the ML.

6. Information Return, Energy Input, and Control Loop

This chapter describes the generation and return of potential differences, as well as their processing within the triadic coupling. It also examines the different processing methods employed by fundamentally projecting quantum points (FPQPs) and manifesting quantum points (MQPs), together with the resulting dynamic effects.

6.1. Potential Difference

Interactions can cause the actual potential utilisation of a quantum point (QP) to increase beyond the target potential utilisation prescribed by its determination (DT). The resulting deviation is referred to as the potential difference ΔP .

The target potential utilisation of a QP results from its fundamental potential utilisation and the additional influence quantity of the DT intended for its respective quantum space (QS).

The potential difference is given by:

$$\Delta P = P_{ist} - P_{soll}$$

In the feedback process described here, a positive potential difference is relevant. When $\Delta P = 0$, the actual potential utilisation equals the target potential utilisation. When $\Delta P > 0$, the actual potential utilisation exceeds the target potential utilisation, and the resulting deviation can be returned as an influence quantity.

6.2. Return of Potential Differences via Bypasses

The bypass forms the structural return channel within a triadic coupling (Figure 4). It runs opposite to the direction of projection, from the Material Layer (ML), through the Subtle Layer (SL), to the Quantum Layer (QL).

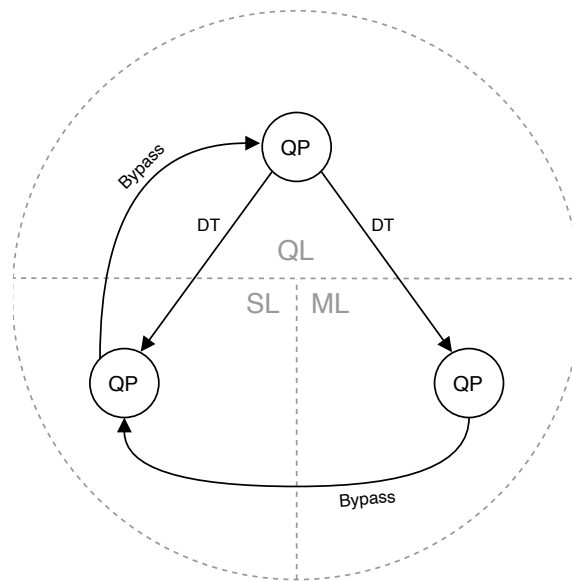


Figure 4: Triadic Coupling with Bypass

When a potential difference occurs at a QP on the ML, it is returned as an influence quantity via the bypass to the associated QP on the SL. The incoming influence quantity may affect the QP on the SL. The specific mechanism of this effect and the conditions under which it occurs are not defined in greater detail in the FQSM at this point.

The potential difference originating on the ML is forwarded through the SL to the QL, regardless of whether it affects the QP on the SL. If a separate potential difference arises on the SL, this is also returned via the same bypass as a distinct influence quantity.

The following applies to each individual potential difference: when $\Delta P = 0$, no return occurs; when $\Delta P > 0$, the corresponding deviation is passed on as an influence quantity. No potential is transferred through the bypasses. The returned influence quantities can be processed by the QL and taken into account in subsequent projections.

6.3. Effects of External Energy Input

A manifestation on the ML can be affected by external energy. Possible forms of external energy input include light, heat, and mechanical impact.

When external energy acts on QPs on the ML, their oscillation states and actual potential utilisation may change. If the actual potential utilisation P_{ist} exceeds the target potential utilisation P_{soll} prescribed by the DT, a potential difference ΔP arises. This is returned via the bypass to the associated QP on the SL.

The returned influence quantity is processed on the SL in accordance with the laws governing that layer. This may also change the potential utilisation of the affected QP, resulting in a further potential difference that is returned via the bypass to the QL. The way these returned potential differences are processed differs between FPQPs and MQPs.

6.4. Different Processing by FPQPs and MQPs

The DT specifies the fundamental potential utilisation and contains two additional influence quantities for the extended potential utilisation on the SL and ML. Both QPs of a projection pair receive the same DT but process it in accordance with the laws governing their respective QS. In the absence of additional interactions, a QP on a projection surface is in a neutral state prescribed by the DT. An FPQP projects the Fundamental Determination, whereas the DT of an MQP specifies a higher fundamental potential utilisation.

- **FPQP:** The potential differences originating on the SL and ML and returned through the bypass to the QL are transferred back to the projection pair separately, in accordance with their respective assignments in the DT, at the next projection. Once transferred, these returned potential differences are no longer retained by the FPQP. If no new potential differences are returned via the bypasses, the FPQP does not transfer any further potential differences during subsequent projection impulses. No accumulation over multiple projection impulses takes place.
- **MQP:** The potential differences originating on the SL and ML and returned through the bypass to the QL are accumulated separately over multiple projection impulses while external energy input continues. Once the energy input ends, both accumulated total potential differences are transferred to the projection pair in a single operation, via the corresponding influence quantities of the DT, with the next projection impulse. Both total potential differences are fully released by the MQP.

6.5. Accumulation and Release of Potential Differences

While external energy input continues, the MQP separately accumulates the potential differences returned via the bypasses for the SL and ML. Each of the two sums is referred to as a QS-specific total potential difference, ΔP_{ges} .

When the external energy input ends, no further potential differences caused by that energy input arise. With the subsequent projection impulse, the MQP transfers both accumulated, QS-specific total potential differences ΔP_{ges} to the associated projection pair via the corresponding influence quantities of the DT. Both total potential differences are thereby fully released by the MQP.

The central QPs of the projection surfaces process the projected DT, including the respective potential difference conveyed to them. They obtain the potential required for this processing from the Primordial Substrate. The resulting potential uptake occurs once. On the SL, the central QP may then emit an FB with a shockwave-like effect, influencing further QPs on the SL. The strength of this effect depends on the magnitude of the previously accumulated total potential differences.

On the ML, the effects may initially become apparent as changes in the properties of the manifestation. Depending on the strength of the excitation and the laws governing the ML, the consequences may extend to catastrophic changes.

6.6. Attenuation of Excitation within the Influence Field

The interactions triggered by the shockwave lead to further potential differences, which are returned via the bypasses from the ML, through the SL, to the QL. The central QP on the ML may also return potential differences without itself being part of the manifested structure.

These returns and the resulting interactions give rise to further temporally staggered processes within the influence field. The participating QPs affect one another, gradually weakening the effects of the original excitation.

The attenuation process results from the combined interactions of the participating QPs within the influence field. It does not arise from a change in the processing behaviour of the central QP on the SL, but from the ongoing processing of interactions and returns throughout the system.

6.7. The Closed Control Loop

The combination of projection and feedback establishes a closed control loop within the triadic coupling. Projection transfers the DT from the QL to the associated QPs on the SL and ML. These QPs process the DT and incoming influence quantities in accordance with the laws governing their respective QS. The resulting potential differences are returned to the QL via the bypasses, opposite to the direction of projection. There, the influence quantities are processed and can be taken into account in subsequent projections.

The control loop thus encompasses the projection of the DT, its processing within the QS, the return of resulting potential differences, and their consideration in subsequent projections. The spatial positions of the QPs and the fundamental coupling structure remain unchanged.

7. Summary

Part 3 of the Fractal Quantum Space Model (FQSM) describes the oscillation dynamics of quantum points, the generation of frequency bubbles, the development of influence fields, and feedback between the quantum spaces.

The Fundamental Determination prescribes the fundamental oscillation of a quantum point and the potential utilisation required for it. Repeated projection impulses stimulate the oscillation process. Interactions can change the oscillation state and the actual potential utilisation.

Frequency bubbles are generated by quantum points on the Subtle Layer and propagate through the Primordial Substrate. They convey the oscillation state of the generating quantum point and information about the amount of potential used. Their potential density decreases with increasing distance in proportion to $(1/r^2)$. Interactions caused by frequency bubbles can trigger the generation of further frequency bubbles, giving rise to cascades with spatially distributed influence fields.

When the excitation of a projection pair reaches the stimulation threshold, a manifestation on the Material Layer may arise. The manifestation process described here is initiated by a manifesting quantum point. However, the central quantum point of the manifestation on the Material Layer does not participate in the manifested structure.

Interactions and external energy input can give rise to potential differences, which are returned via the bypasses from the Material Layer, through the Subtle Layer, to the Quantum Layer. Fundamentally projecting quantum points take these returns into account in subsequent projections. In manifesting quantum points, potential differences are accumulated separately for the Subtle Layer and the Material Layer while external energy input continues. Once the energy input ends, the accumulated potential differences are fully released with the next projection impulse. This can give rise to strong, shock-wave-like interactions whose effects gradually diminish through the combined interactions of the participating quantum points within the influence field.

The combination of projection and feedback establishes a closed control loop. The spatial positions of the quantum points and the fundamental coupling structure remain unchanged. Further mechanisms governing interactions and binding processes in the near field of a manifestation are addressed in subsequent parts of the FQSM.