The Hilbert Book Model

A simple Higgsless model of fundamental physics

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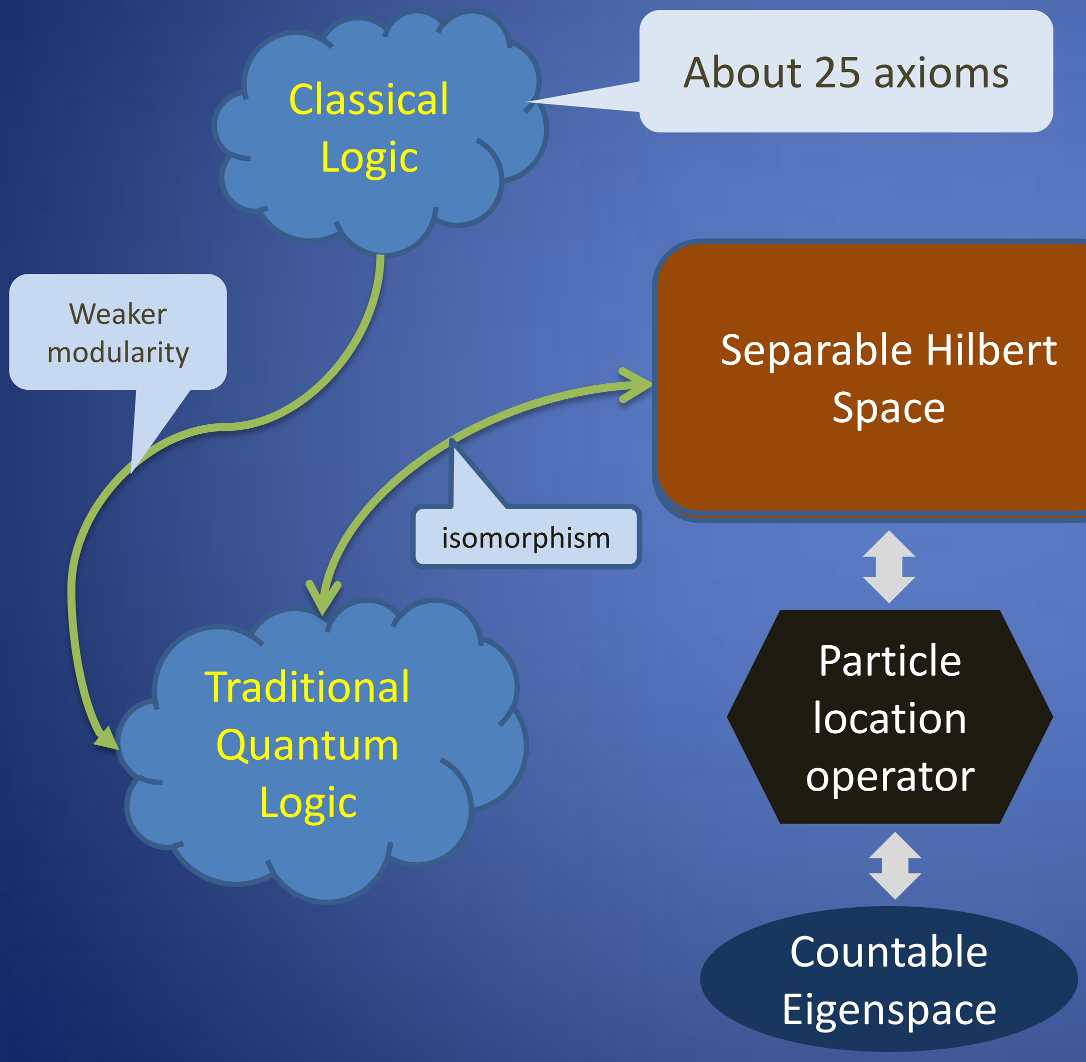
What is the HBM ?

- The Hilbert Book Model is a simple self consistent model of fundamental physics that is strictly based on traditional quantum logic
- It uses a sequence of instances of an extension of a quaternionic separable Hilbert space that each represents a static status quo of the whole universe
- This gives the model the form of a book

The HBM treats fundamental physics as a space streaming problem

First Model



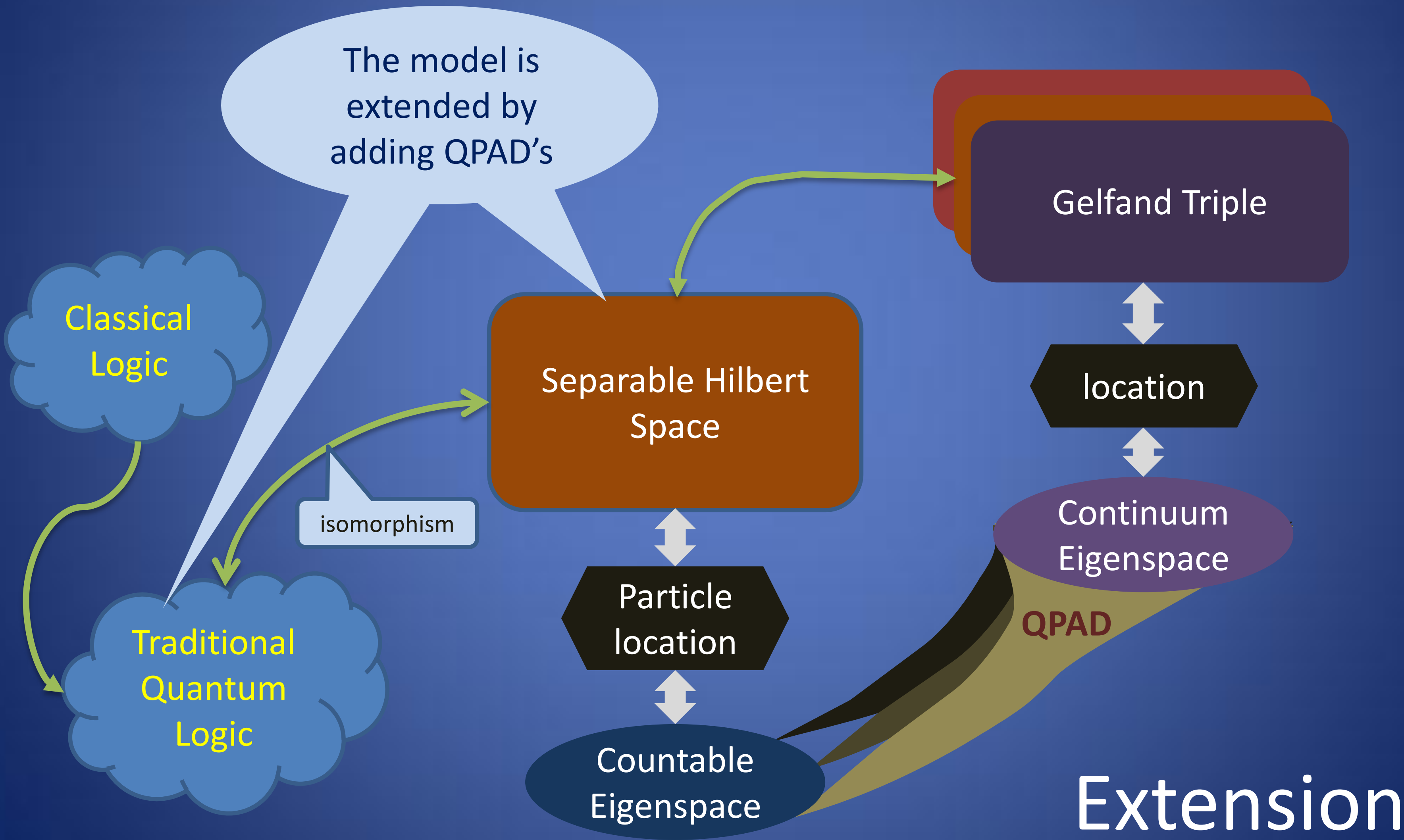
Only static status quo

&

No fields

HBM Page

Static Status Quo of the Universe



QPAD

Quaternionic Probability Amplitude Distribution

Probability Amplitude Distributions

quantum state functions are probability amplitude distributions.

Instead of Complex Probability Amplitude Distributions (CPAD’s) , the HBM uses the more flexible QPAD’s

QPAD versus CPAD

Selecting a QPAD instead of a CPAD is a mathematical decision

It does not change physical reality

It changes the view of physics that is obtained

It turns the theory of fundamental physics into a streaming problem

Nature’s Strategy

The PAD represents the way that nature solves the dilemma that a potentially much larger set of observations that reside in a continuum must fit onto a restricted set of problem carriers (the Hilbert eigenvectors)

Magic Wand

= QPAD + Hilbert eigenvector

QPAD's I

- A QPAD is a quaternionic probability amplitude distribution.

- quantum state function QPAD's link Hilbert eigenvectors to a value in a continuum eigenspace in the Gelfand triple.

- Operators in a separable Hilbert space have a countable number of eigenvalues

QPAD's II

The real part of a static QPAD is a "charge" density distribution.

The imaginary part is a "current" density distribution.

The squared modulus of the QPAD describes the distribution of the probability of the presence of the carrier of the charges.

A static QPAD can still have currents = uniformly moving charges!

QPAD’s III

The charge can be any property of the carrier or even the complete ensemble of properties of the carrier (except location).

The Palestra is the shared parameter space of all QPAD’s.

QPAD’s extend over the whole parameter space. (cover the whole universe)

QPAD’s may contain

- Carriers*
- Carrier presence density distribution*
- Charge density distribution
- Current density distribution
- Sources
- Drains
- Compression regions
- Decompression regions
- Vortexes

*Also occur with CPAD’s

Helmholtz decomposition

Only in a static QPAD the charge density distribution and the current density distribution are completely independent

The charge density distribution is rotation free.
The current density distribution is divergence free.

Typical Source QPAD I

An isotropic source QPAD is generated by a Poisson process.

The result is a Poisson distribution of charge carriers.

If the efficiency of the process is high enough, then the distribution approaches a Gaussian distribution.

The currents are directed outward.

Typical Source QPAD II

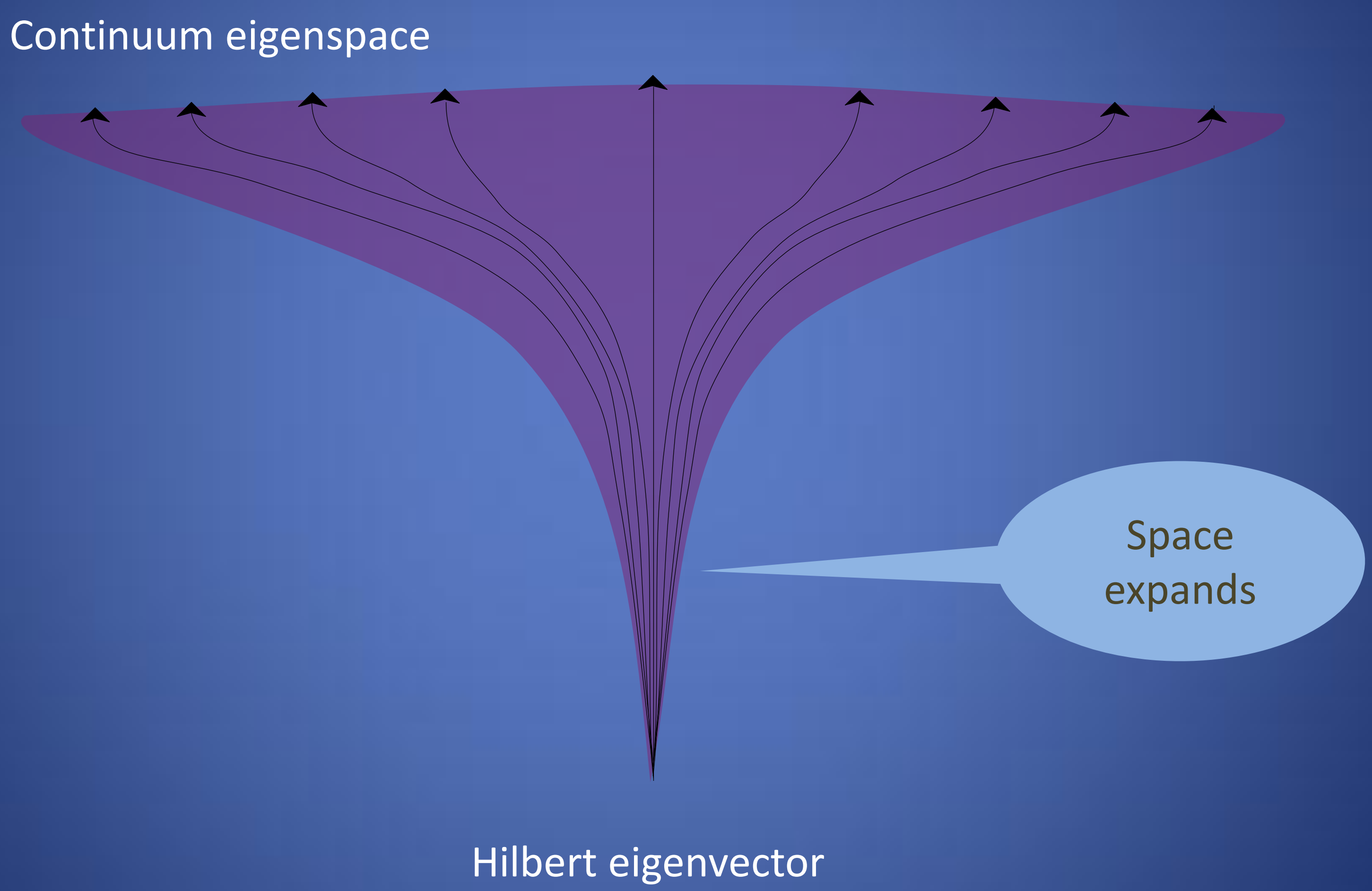
The charges go together with a potential that has the form of an Error function. At a small distance from the center, this function can be approached by $1/r$.
(No singularity occurs!)

The produced carriers can be interpreted as tiny patches of the parameter space.

In this way the QPAD may influence the curvature of the parameter space

The background QPAD is an example of an isotropic source QPAD

Typical Source QPAD III



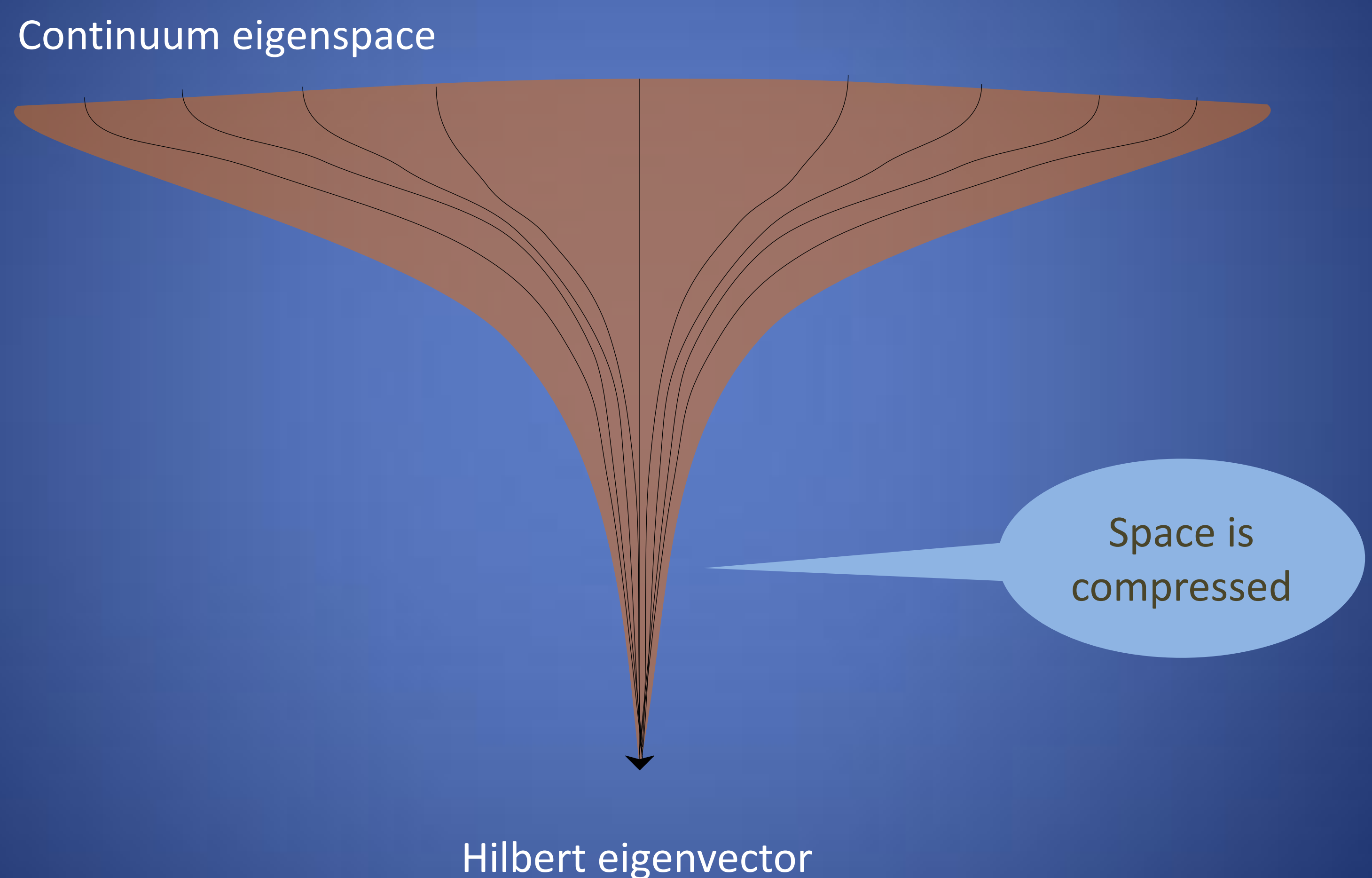
Typical Drain QPAD I

Similar to source QPAD, but the currents are reversed.

An example of an isotropic drain QPAD is the average quantum state function QPAD.

Here, the carriers ride on parameter space patches that were stolen from the carriers in the tails of other QPAD's

Typical Drain QPAD II



Hybrid QPAD's

Some QPAD's are a mixture of a source QPAD in one or two dimensions and a drain QPAD in the other dimension(s).

Examples are formed by the quantum state functions of neutrinos and down-quarks.

Oscillating QPAD’s

If QPAD’s are not coupled, then they must oscillate. Otherwise, their value is zero.

These QPAD’s oscillate between source and drain modes.

Or they constitute plain waves.

Examples are formed by photons and gluons.

Palestra

Palestra is the parameter space that is shared by all QPAD's in the HBM and by all fields that are derived from these QPAD's

It is the playground of everything that happens in universe

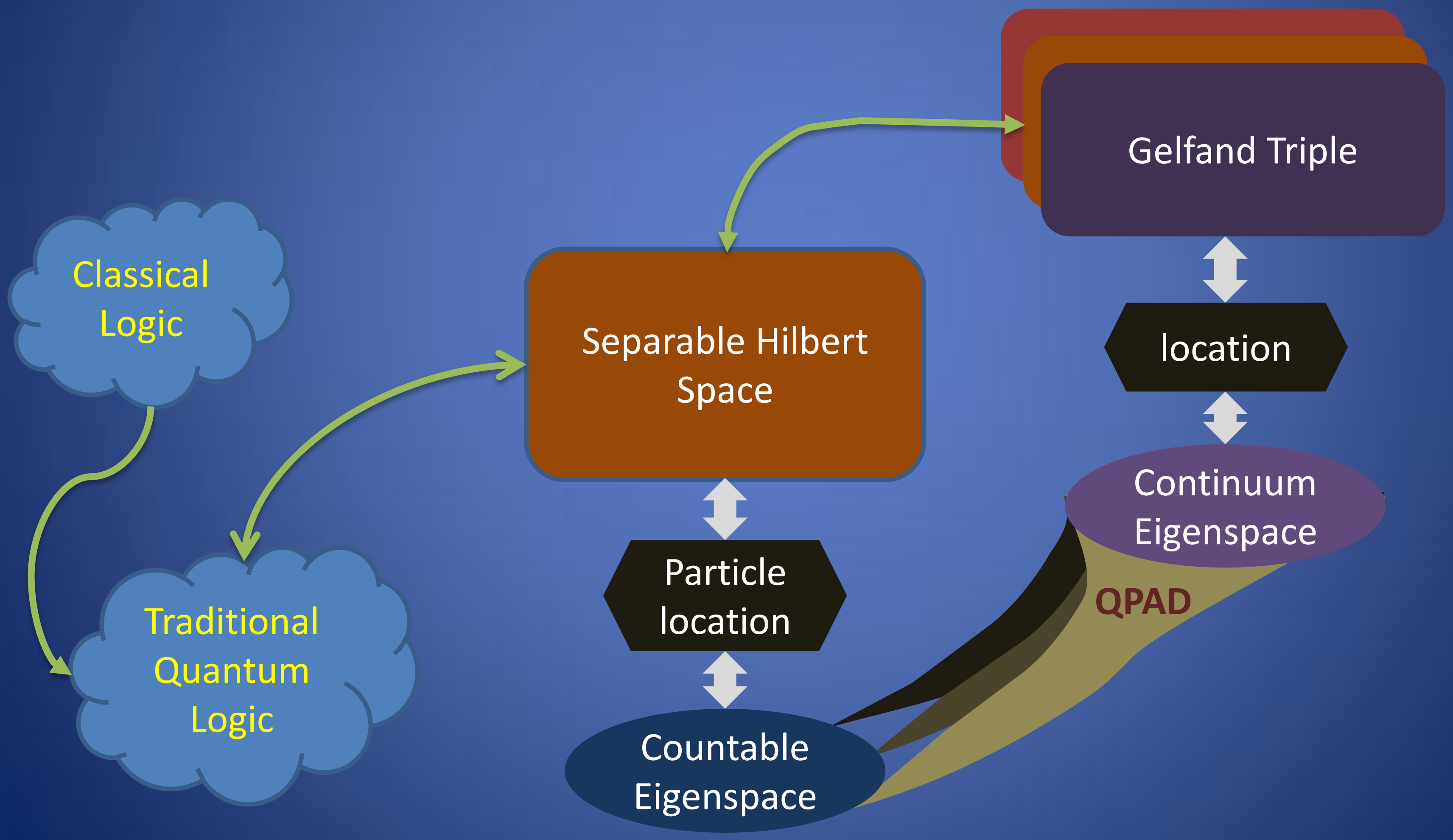
The QPAD's describe what happens in Palestra

Dynamics

The way the HBM implements dynamics

Single HBM Page

Static Status Quo of the Universe



Dynamics

- The HBM implements dynamics by considering a sequence of HBM pages that each represents a static status quo of the whole universe.

- This renders the model as a book:

  The Hilbert Book Model

- The page counter acts as the progression parameter.

Spacetime

- The progression parameter differs from our common notion of time.
- Space and time are only related when an observed item moves with respect to the observer.
- Displacements are governed by the displacement group.

Uniform displacements

- When uniform displacements are involved, the properties of the displacement group lead to three cases:
  - Displacements described by a Galileo transformation
  - Displacements described by a Lorentz transformation (when a maximum speed exists)
  - A non-physical case where space can be transformed into time and vice versa

Notions of time

- The Lorentz transform introduces two notions of time:
  - Proper time = time of the observed item
  - Coordinate time = time of the observer
- The Lorentz transform introduces several special features:
  - Time dilatation
  - Length contraction

Progression

- If not otherwise stated the HBM uses the progression parameter.
- In some cases it uses the spacetime step, which characterizes the Minkowski space:
- $ds^{2} = dt^2 - dq^2/c^2$
- ds = spacetime step
- dt = coordinate time step
- dq = position step
- $\tau = \int_{path} ds = \int_{path} \sqrt{dt^2 - dq^2/c^2}$ = proper time

In a Single HBM Page

- All objects are static
- Helmholtz decomposition theorem rules
- Relativity makes no sense
- Spacetime makes no sense
- One instance of the progression parameter characterizes all objects

A HBM page represents the static status quo of the whole universe.

Between HBM Pages

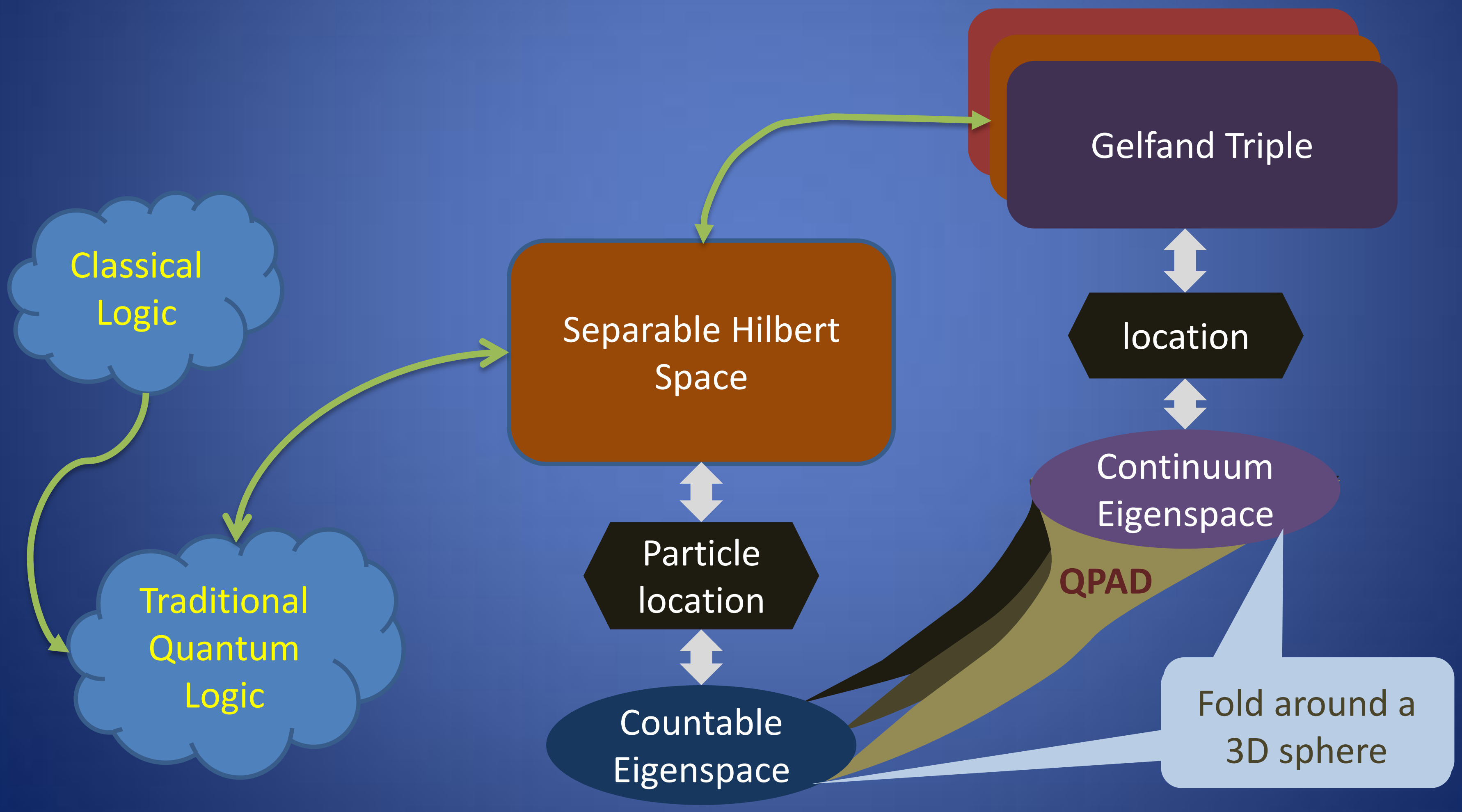
- Dynamics rules
- Relativity makes sense
  - Spacetime exists
  - Coordinate time exists
  - Proper time exists
- The progression parameter indicates progression
- A change of currents goes together with the existence of an extra field component

The QPAD-sphere

The space atmosphere

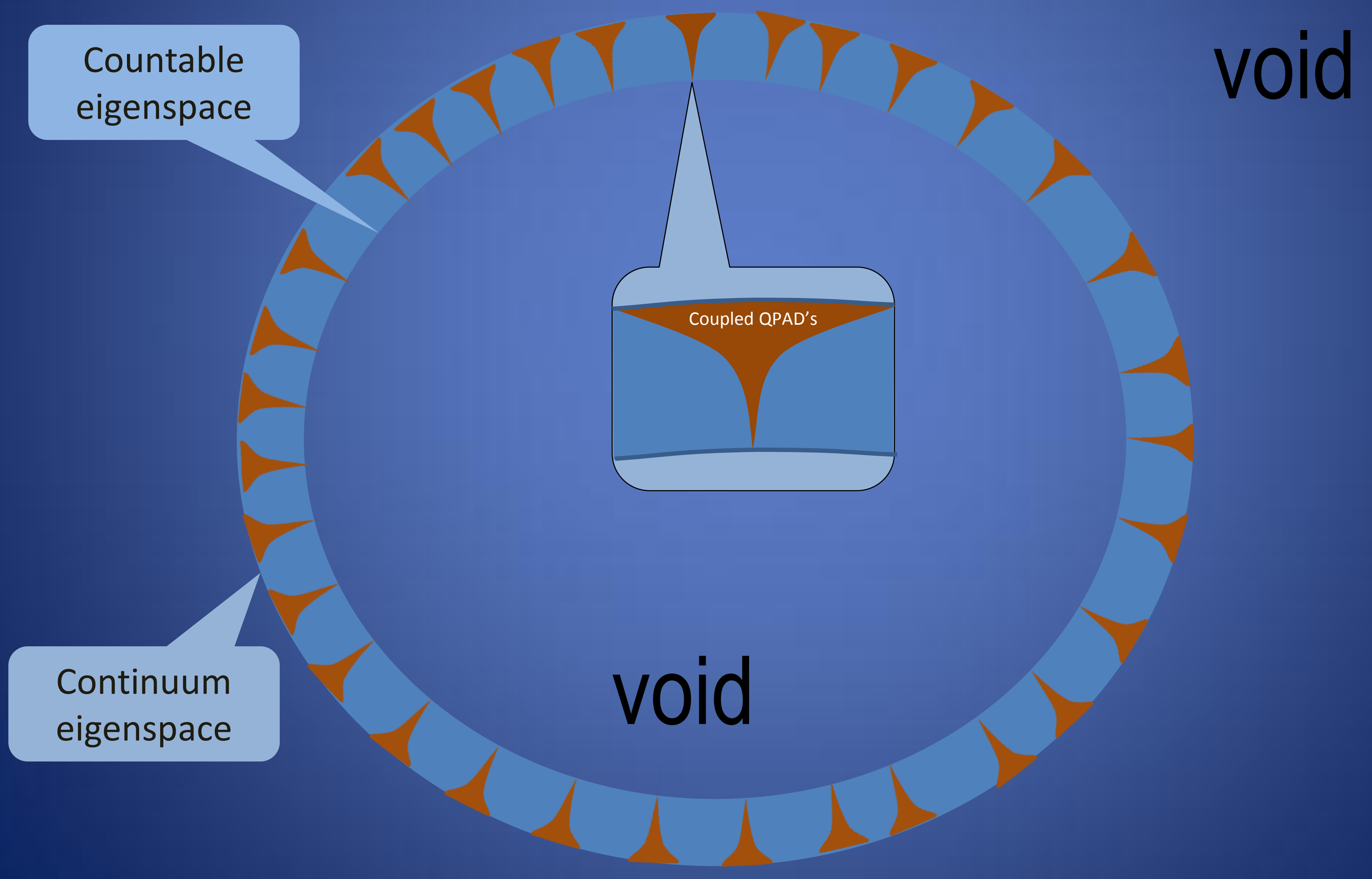
Single HBM Page

Static Status Quo of the Universe

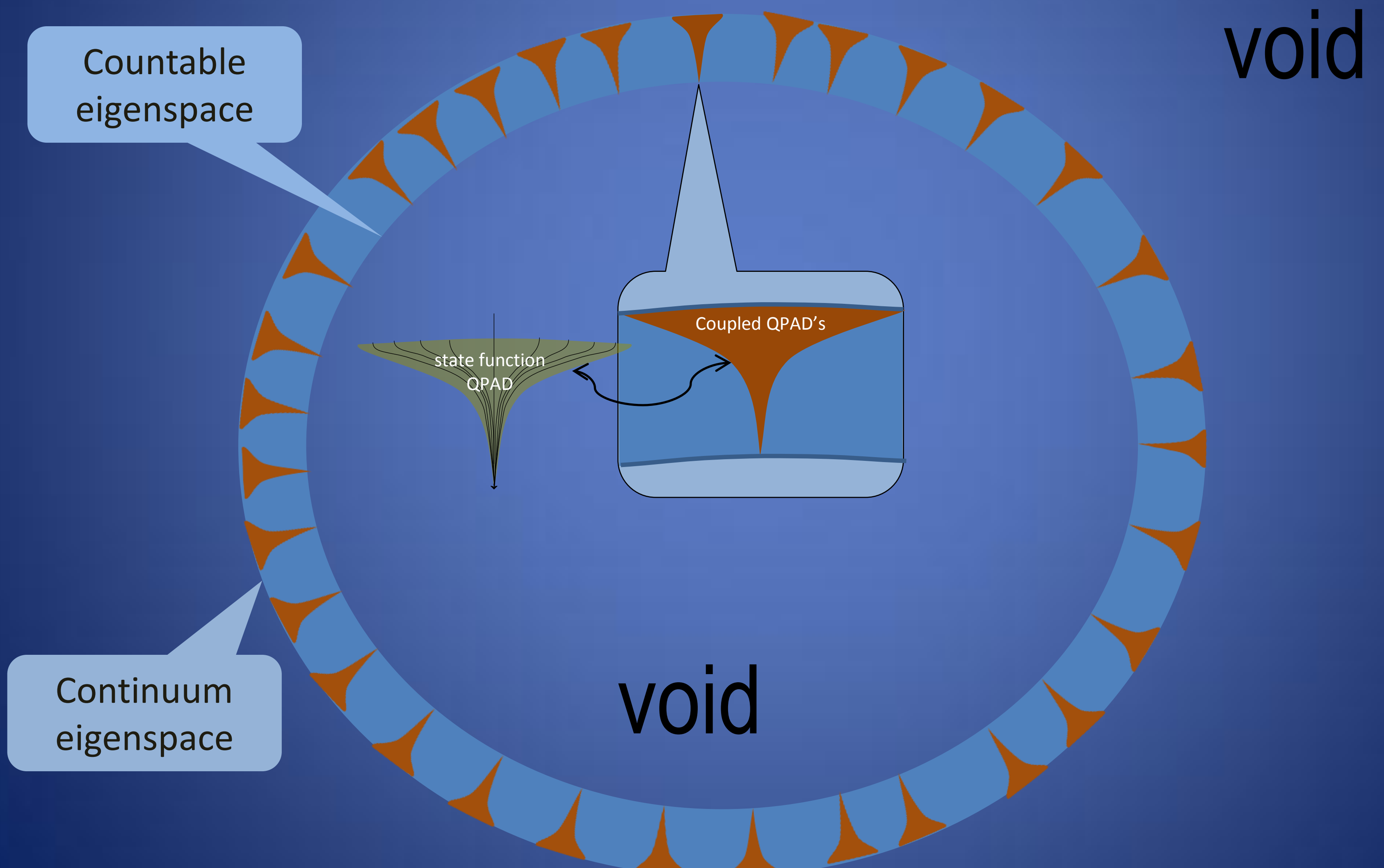


QPAD-sphere
Configuration space

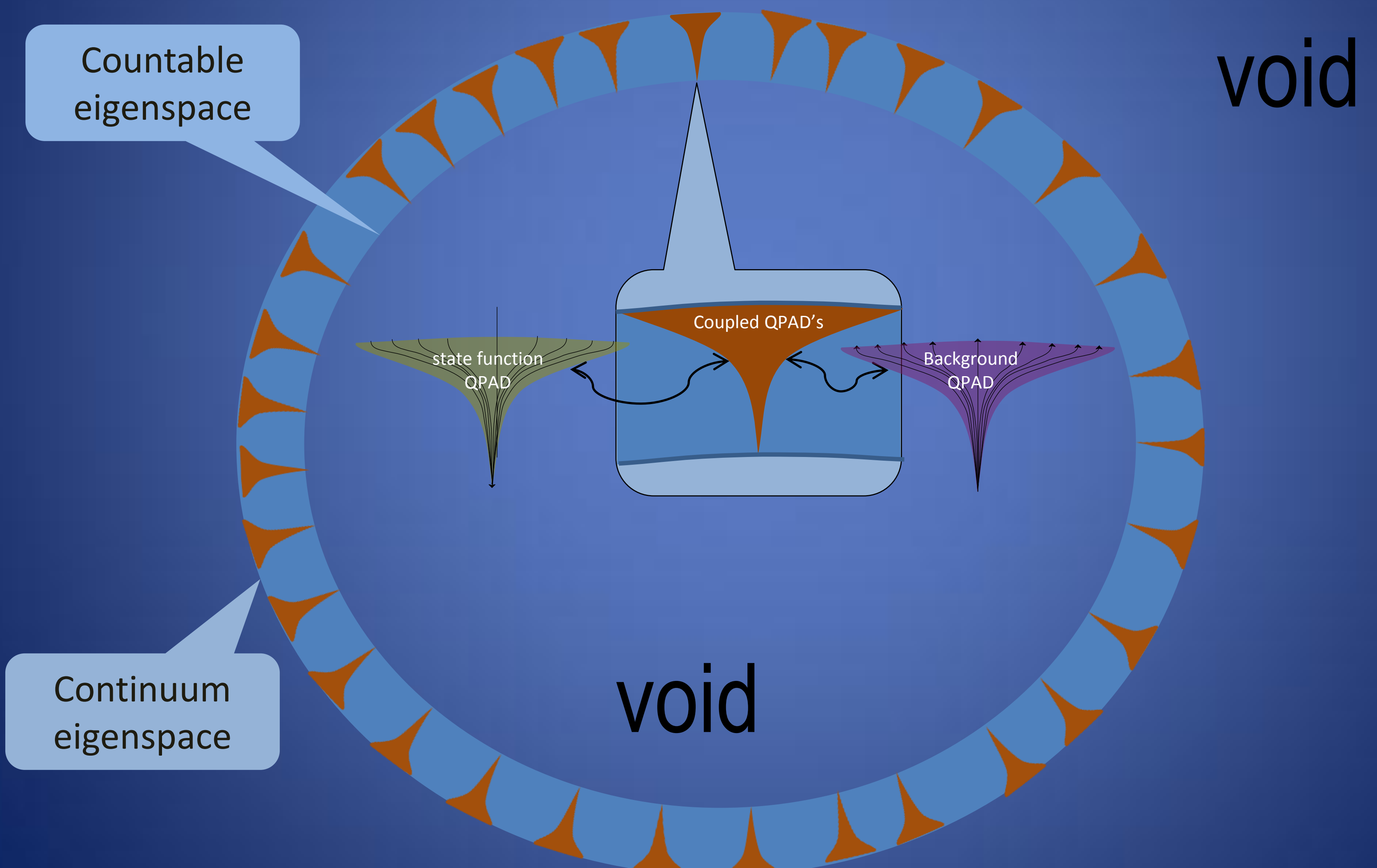
QPAD-sphere
Configuration space



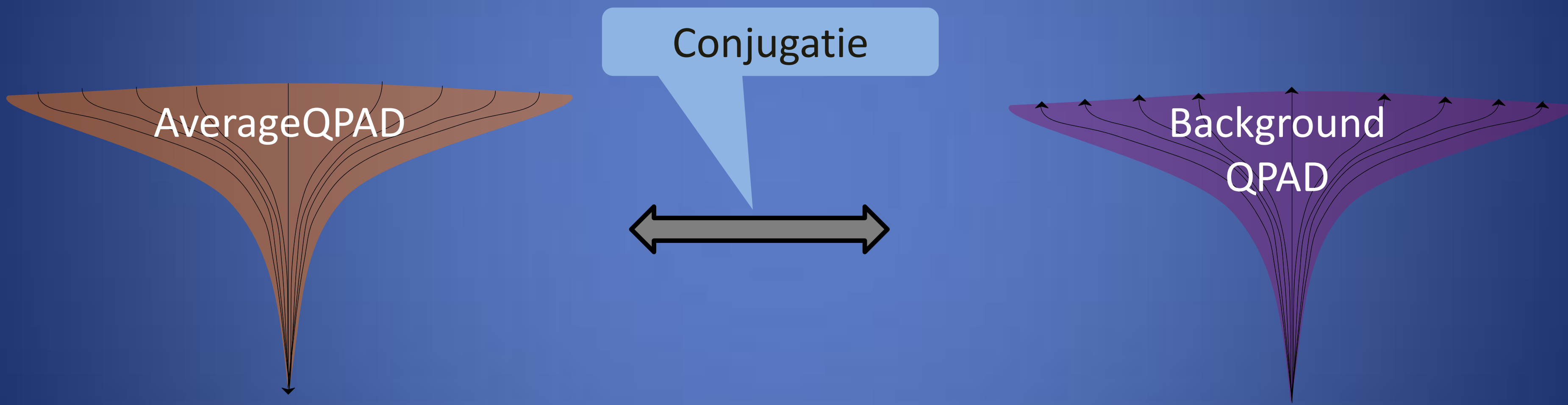
QPAD-sphere Configuration space



QPAD-sphere Configuration space

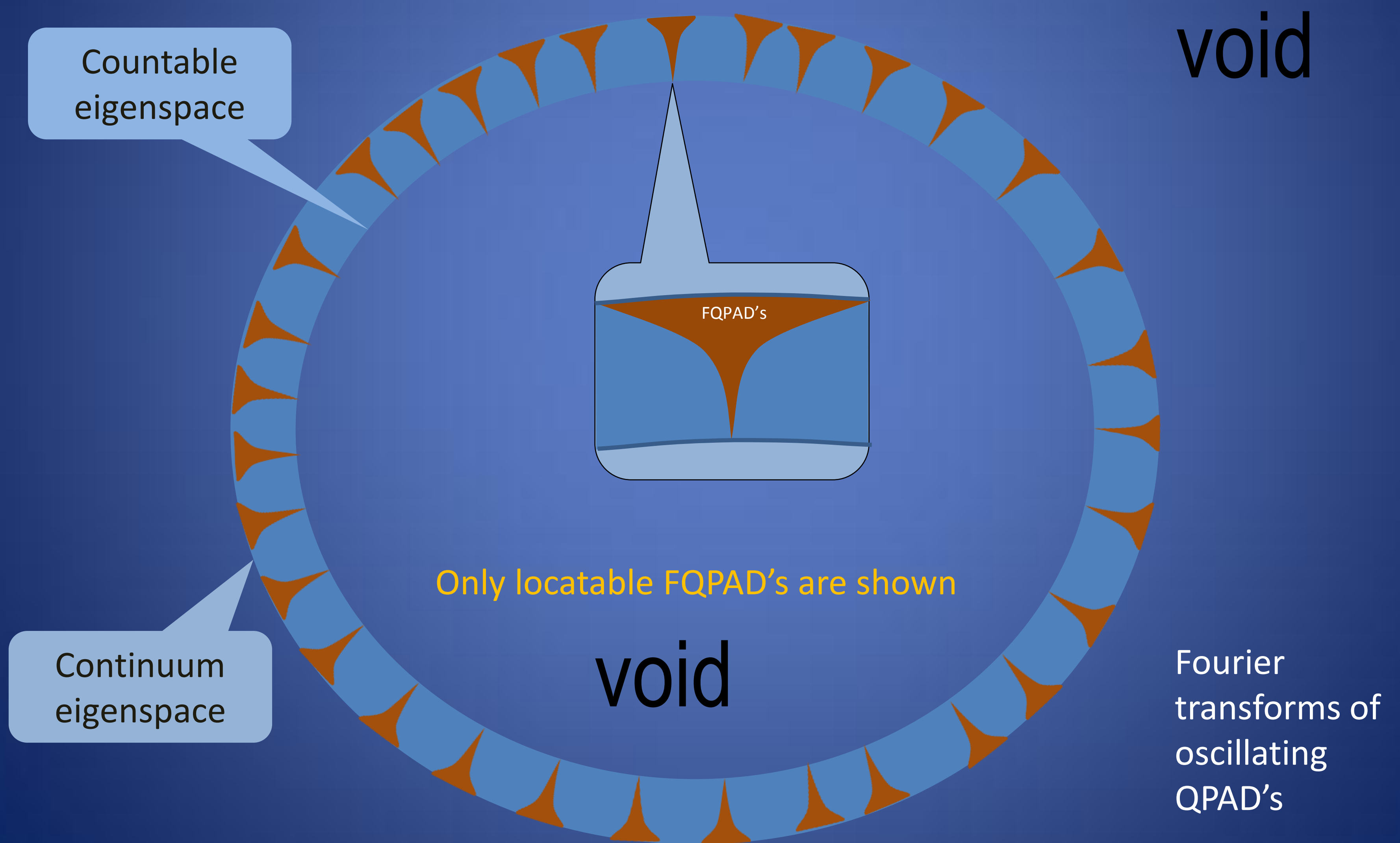


Average State Function QPAD



This picture holds for isotropic background QPAD's.
Anisotropic background QPAD's have a similar relation.

FQPAD-sphere Momentum space



Motion

Space Balance Equation

Equations of motion

- Using QPAD’s as state functions changes equations of motion into continuity
- (= balance) equations.

- This avoids the road via geodesics, geodesic equations and the minimal action principle

Continuity Equation
Global view

Total change within *V* = flow into *V* + production inside *V*

$$\frac{d}{dt}\int_V \rho_0 \, dV = \oint_S \hat{\boldsymbol{n}}\rho_0 \frac{\boldsymbol{v}}{c} \, dS + \int_V s_0 \, dV$$

$$\int_V \nabla_0 \rho_0 \, dV = \int_V \langle \boldsymbol{\nabla}, \boldsymbol{\rho} \rangle \, dV + \int_V s_0 \, dV$$

Here $\hat{\boldsymbol{n}}$ is the normal vector pointing outward the surrounding surface *S*, $\boldsymbol{v}(t, \boldsymbol{q})$ is the velocity at which the charge density $\rho_0(t, \boldsymbol{q})$ enters volume *V* and s_0 is the source density inside *V.* In the above formula $\boldsymbol{\rho}$ stands for

$$\boldsymbol{\rho} = \rho_0 \boldsymbol{v}/c$$

Continuity equation
Local view

$\boldsymbol{\rho}(t, \boldsymbol{q})$ is the flux (flow per unit area and per unit time) of ρ_0 .

The combination of $\rho_0(t, \boldsymbol{q})$ and $\boldsymbol{\rho}(t, \boldsymbol{q})$ is a quaternionic skew field $\rho(t, \boldsymbol{q})$ and can be seen as a probability amplitude distribution (QPAD).

$$\nabla_0 \rho_0 = \langle \nabla, \boldsymbol{\rho} \rangle + s_0$$

Quaternionic nabla

Full differential:

Source or drain

$$\nabla \rho = s$$

Dirac equation

The quaternionic format of the Dirac equation and of the Majorana equation induces the general format of the elementary coupling equation.

spinor

$$\nabla_0[\psi] + \boldsymbol{\nabla\alpha}[\psi] = m\beta[\psi]$$

QPAD

$$\nabla_0\psi_R + \boldsymbol{\nabla}\psi_R = m\psi_L$$

QPAD

$$\nabla_0\psi_L - \boldsymbol{\nabla}\psi_L = m\psi_R$$

Elementary coupling

Special form of continuity equation

Quaternionic nabla

Sign flavor index

$$\nabla\psi^{x} = m\,\psi^{y}$$

Source term

State function QPAD

Coupling factor

Coupled QPAD

Couples different sign flavors of the same base QPAD ψ^{0}

Anti-particle Equation

Sign flavor index

Quaternionic nabla

$$\nabla^* \psi^{x*} = m\, \psi^{y*}$$

Source term

State function QPAD

Coupling factor

Coupled QPAD

Taking conjugates of all terms, including nabla operator, but not of parameters. So, it is a different equation!

Shadow Particle Equation

Quaternionic nabla

Sign flavor index

$$\nabla \psi^{x*} = m\, \psi^{y*}$$

Source term

State function QPAD

Coupling factor

Coupled QPAD

Taking conjugates of all terms, excluding nabla operator, but not of parameters.
It is the shadow of the antiparticle.

Coupling Factor m

$$\nabla\psi^{x} = m\,\psi^{y}$$

$$\int_V \psi^{y*}\nabla\psi^{x}\,dV = m\int_V \psi^{y*}\psi^{y}\,dV$$

Positive real number

$$\int_V \psi^{y*}\nabla\psi^{x}\,dV = m\,g$$

m can be computed from ψ

Zero Coupling Factor

$$\nabla\psi^x = m\,\psi^x$$

Involves:

$$\nabla\psi^x = 0$$

Thus, either

$$\psi^x = 0,\ \text{or}$$
$$\nabla\nabla^*\psi^x = 0, \text{or}$$
$$\nabla\nabla\psi^x = 0$$

This leads to oscillating (Maxwell) fields

Relation to Maxwell Fields

$$\nabla \psi^x = 0$$

$$\nabla_0 \psi_0^x = \langle \boldsymbol{\nabla}, \boldsymbol{\psi}^x \rangle$$

$$\boldsymbol{\nabla} \times \boldsymbol{\psi}^x + \boldsymbol{\nabla} \psi_0^x + \nabla_0 \boldsymbol{\psi}^x = \mathbf{0}$$

$$\boldsymbol{B} = \boldsymbol{\nabla} \times \boldsymbol{\psi}^x$$

$$\mathfrak{E} = -\boldsymbol{\nabla} \psi_0^x$$

$$\boldsymbol{E} = -\boldsymbol{\nabla} \psi_0^x - \nabla_0 \boldsymbol{\psi}^x = \mathfrak{E} - \nabla_0 \boldsymbol{\psi}^x$$

This does not say that these equations are Maxwell equations

Elementary particles and waves

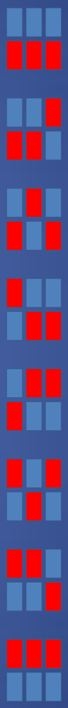
Elementary Coupling Mechanism

Sign selections

Quaternions allow four independent sign selections

- Conjugation
- Reflection (3 directions, colors R,G,B)

Together they constitute eight mixed sign selections



$N\ R$

$R\ L$

$G\ L$

$B\ L$

$\bar{R}\ R$

$\bar{G}\ R$

$\bar{B}\ R$

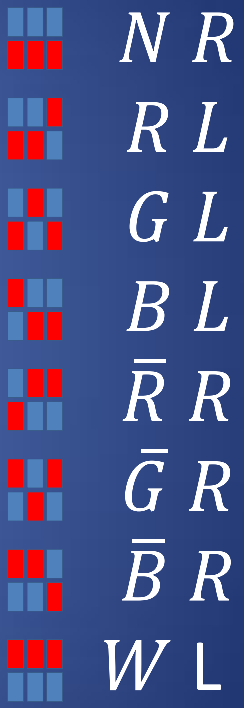
W L

Sign flavors

Quaternionic distributions (QD’s) exist in eight different sign flavors

Sign flavors of QD’s refer for their base to the sign flavor of the parameter space

Elementary couplings couple sign flavors that belong to the same base QPAD

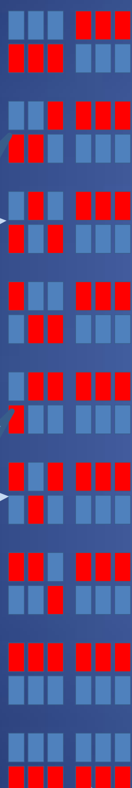


Elementary couplings

QPAD pairs

neutri nos

down quarks



# switches	Handedness	Charge	F/B	Color	m	type
-3	RL Switched	-e	F	n	>0	$\{\psi^{\textcircled{0}},\psi^{\textcircled{7}}\}$
-2	LL Same	0	F	R	>0	$\{\psi^{\textcircled{1}},\psi^{\textcircled{7}}\}$
-2	LL Same	0	F	G	>0	$\{\psi^{\textcircled{2}},\psi^{\textcircled{7}}\}$
-2	LL Same	0	F	B	>0	$\{\psi^{\textcircled{3}},\psi^{\textcircled{7}}\}$
-1	RL Switched	-1/3 e	F	$\bar{B}$	>0	$\{\psi^{\textcircled{4}},\psi^{\textcircled{7}}\}$
-1	RL Switched	-1/3 e	F	$\bar{G}$	>0	$\{\psi^{\textcircled{5}},\psi^{\textcircled{7}}\}$
-1	RL Switched	-1/3 e	F	$\bar{R}$	>0	$\{\psi^{\textcircled{6}},\psi^{\textcircled{7}}\}$
0	LL Same	0	B	n	0	$\{\psi^{\textcircled{7}},\psi^{\textcircled{7}}\}$
0	RR Same	0	B	n	0	$\{\psi^{\textcircled{0}},\psi^{\textcircled{0}}\}$

electron

State function QPAD

Coupled QPAD

What are these?

photons

Guessing the Rules

- If handedness is the same, then the particle has no charge
- Else, # switches determines charge
- Fermions are coupled to an isotropic background QPAD
- Anisotropic conditions define a direction dependent color charge

Table

Restricted Elementary Couplings

nr	pair	type	+/-	RL	e-charge	color	description
1	$\{\psi^{⓪},\psi^{⓪}\}$	boson	0	RR	0	none	photon
2	$\{\psi^{⓪},\psi^{①}\}$	boson	-1	RL	-1/3 e	$\mathbf{R}$	XX
3	$\{\psi^{⓪},\psi^{②}\}$	boson	-1	RL	-1/3 e	$\mathbf{G}$	XX
4	$\{\psi^{⓪},\psi^{③}\}$	boson	-1	RL	-1/3 e	$\mathbf{B}$	XX
5	$\{\psi^{⓪},\psi^{④}\}$	boson	-2	RR	0	$\overline{B}$	Anti Z
6	$\{\psi^{⓪},\psi^{⑤}\}$	boson	-2	RR	0	$\overline{G}$	Anti Z
7	$\{\psi^{⓪},\psi^{⑥}\}$	boson	-2	RR	0	$\overline{R}$	Anti Z
8	$\{\psi^{⓪},\psi^{⑦}\}$	fermion	-3	RL	-e	none	electron

nr	pair	type	+/-	RL	e-charge	color	description
9	$\{\psi^{①}, \psi^{⓪}\}$	fermion	1	LR	1.3 e	R	anti-down quark
10	$\{\psi^{①}, \psi^{①}\}$	boson	0	LL	0	RR	gluon
11	$\{\psi^{①}, \psi^{②}\}$	boson	0	LL	0	RG	multicolor
12	$\{\psi^{①}, \psi^{③}\}$	boson	0	LL	0	RB	multicolor
13	$\{\psi^{①}, \psi^{④}\}$	boson	1	LR	1/3 e	$\mathrm{R}\bar{B}$	YY
14	$\{\psi^{①}, \psi^{⑤}\}$	boson	1	LR	1/3 e	$\mathrm{R}\bar{G}$	YY
15	$\{\psi^{①}, \psi^{⑥}\}$	boson	-3	LR	-e	$\mathrm{R}\bar{R}$	W_{-}
16	$\{\psi^{①}, \psi^{⑦}\}$	fermion	-2	LL	0	R	neutrino

nr	pair	type	+/-	RL	e-charge	color	description
17	$\{\psi^{②}, \psi^{⓪}\}$	fermion	1	LR	1.3 e	G	Anti-down quark
18	$\{\psi^{②}, \psi^{①}\}$	boson	0	LL	0	GR	multicolor
19	$\{\psi^{②}, \psi^{②}\}$	boson	0	LL	0	GG	gluon
20	$\{\psi^{②}, \psi^{③}\}$	boson	0	LL	0	GB	multicolor
21	$\{\psi^{②}, \psi^{④}\}$	boson	-1	LR	-1/3 e	$G\bar{B}$	ZZ
22	$\{\psi^{②}, \psi^{⑤}\}$	boson	-3	LR	-e	$G\bar{G}$	W_{-}
23	$\{\psi^{②}, \psi^{⑥}\}$	boson	-1	LR	-1/3 e	$G\bar{R}$	ZZ
24	$\{\psi^{②}, \psi^{⑦}\}$	fermion	-2	LL	0	G	neutrino

nr	pair	type	+/-	RL	e-charge	color	description
25	$\{\psi^{③},\psi^{⓪}\}$	fermion	1	LR	1.3 e	B	anti-down quark
26	$\{\psi^{③},\psi^{①}\}$	boson	0	LL	0	BR	multicolor
27	$\{\psi^{③},\psi^{②}\}$	boson	0	LL	0	BG	multicolor
28	$\{\psi^{③},\psi^{③}\}$	boson	0	LL	0	BB	gluon
29	$\{\psi^{③},\psi^{④}\}$	boson	-3	LR	-e	$\mathrm{B}\bar{B}$	W_{-}
30	$\{\psi^{③},\psi^{⑤}\}$	boson	-1	LR	-1/3 e	$\mathrm{B}\bar{G}$	Y
31	$\{\psi^{③},\psi^{⑥}\}$	boson	-1	LR	-1/3 e	$\mathrm{B}\bar{R}$	Y
32	$\{\psi^{③},\psi^{⑦}\}$	fermion	-2	LL	0	B	neutrino

nr	pair	type	+/-	RL	e-charge	color	description
33	$\{\psi^{④}, \psi^{⓪}\}$	fermion	2	RR	0	$\bar{B}$	anti-neutrino
34	$\{\psi^{④}, \psi^{①}\}$	boson	1	RL	1/3 e	$\bar{B}\mathrm{R}$	anti-Y
35	$\{\psi^{④}, \psi^{②}\}$	boson	1	RL	1/3 e	$\bar{B}\mathrm{G}$	anti-Y
36	$\{\psi^{④}, \psi^{③}\}$	boson	3	RL	e	$\bar{B}$	W_+
37	$\{\psi^{④}, \psi^{④}\}$	boson	0	RR	0	$\bar{B}\bar{B}$	gluon
38	$\{\psi^{④}, \psi^{⑤}\}$	boson	0	RR	0	$\bar{B}\bar{G}$	multicolor
39	$\{\psi^{④}, \psi^{⑥}\}$	boson	0	RR	0	$\bar{B}\bar{R}$	multicolor
40	$\{\psi^{④}, \psi^{⑦}\}$	fermion	-1	RL	-1/3 e	$\bar{B}$	down quark

nr	pair	type	+/-	RL	e-charge	color	description
41	$\{\psi^{⑤}, \psi^{⓪}\}$	fermion	2	RR	0	$\overline{G}$	anti-neutrino
42	$\{\psi^{⑤}, \psi^{①}\}$	boson	1	RL	1/3 e	$\overline{G}\mathrm{R}$	anti ZZ
43	$\{\psi^{⑤}, \psi^{②}\}$	boson	3	RL	e	G	W_+
44	$\{\psi^{⑤}, \psi^{③}\}$	boson	1	RL	1/3 e	$\overline{G}\mathrm{B}$	anti ZZ
45	$\{\psi^{⑤}, \psi^{④}\}$	boson	0	RR	0	$\overline{R}\overline{G}$	multicolor
46	$\{\psi^{⑤}, \psi^{⑤}\}$	boson	0	RR	0	$\overline{G}\overline{G}$	gluon
47	$\{\psi^{⑤}, \psi^{⑥}\}$	boson	0	RR	0	$\overline{G}\overline{R}$	multicolor
48	$\{\psi^{⑤}, \psi^{⑦}\}$	fermion	-1	RL	-1/3	$\overline{G}$	down quark

nr	pair	type	+/-	RL	e-charge	color	description
49	$\{\psi^{⑥}, \psi^{⓪}\}$	fermion	2	RR	0	$\bar{R}$	anti-neutrino
50	$\{\psi^{⑥}, \psi^{①}\}$	boson	3	RL	e	$\bar{R}R$	W_+
51	$\{\psi^{⑥}, \psi^{②}\}$	boson	1	RL	1/3 e	$\bar{R}G$	anti YY
52	$\{\psi^{⑥}, \psi^{③}\}$	boson	1	RL	1/3 e	$\bar{R}B$	anti YY
53	$\{\psi^{⑥}, \psi^{④}\}$	boson	0	RR	0	$\bar{R}\bar{B}$	multicolor
54	$\{\psi^{⑥}, \psi^{⑤}\}$	boson	0	RR	0	$\bar{R}\bar{G}$	multicolor
55	$\{\psi^{⑥}, \psi^{⑥}\}$	boson	0	RR	0	$\bar{B}\bar{B}$	gluon
56	$\{\psi^{⑥}, \psi^{⑦}\}$	fermion	-1	RL	-1/3	$\bar{R}$	down quark

nr	pair	type	+/-	RL	e-charge	color	description
57	$\{\psi^{⑦},\psi^{⓪}\}$	fermion	3	LR	e	none	positron
58	$\{\psi^{⑦},\psi^{①}\}$	boson	2	LL	0	$\mathbf{R}$	Z
59	$\{\psi^{⑦},\psi^{②}\}$	boson	2	LL	0	$\mathbf{G}$	Z
60	$\{\psi^{⑦},\psi^{③}\}$	boson	2	LL	0	$\mathbf{B}$	Z
61	$\{\psi^{⑦},\psi^{④}\}$	boson	1	LR	1/3 e	$\bar{B}$	anti XX
62	$\{\psi^{⑦},\psi^{⑤}\}$	boson	1	LR	1/3 e	$\bar{G}$	anti XX
63	$\{\psi^{⑦},\psi^{⑥}\}$	boson	1	LR	1/3 e	$\bar{R}$	anti XX
64	$\{\psi^{⑦},\psi^{⑦}\}$	boson	0	LL	0	none	photon

Summary of Results I

64 different sign flavor pairs exist.

- 32 zero charge particles exist
  - 12 lost their charge due to missing handedness switch.
  - Otherwise the charge was ± 2 e
- 24 particles exist that have charge ± ⅓ e.
- 8 particles exist that have charge ± e.

Summary of Results II

- We discovered potential representations for all known elementary particles.
- However, the scheme ***cannot*** provide up-quarks
- Anti-particles extend this list. The anti-particles are accompanied by shadow particles.
- W_+ bosons are the anti-particle shadows of W_- bosons.

Are they mesons?

If the multicolor couplings are mesons, then they are elementary particles rather than composites (hadrons).

Standard model

Of the above combinations belong 26 elementary particles and 8 elementary waves to the known standard model

The resulting 64-34 = 30 coupled QPAD’s might be unobservable or they hide behind existing particles (or the mixed color particles are known as mesons)

Fermion generations

The coupling to the isotropic background QPAD $\psi^{⑦}$ result in fermions that feature generations

Generations are different versions of the coupling factor *m*

These particles are leptons and quarks

Anti-particles

Just like the universe is filled with a huge number of particles, it is also filled with a huge number of anti-particles. Otherwise the anti-particles would not sense the same kind of inertia that particles do.

The anti-world has its own kind of general background QPAD.
We christen this version the “background anti-QPAD”.

The isotropic background anti-QPAD represents the local superposition of the tails of the state functions of all anti-particles in universe.

Summary of Discoveries

- The coupling of sign flavors produces products that are similar to known elementary particles.
- All known elementary particles and their anti-particles are covered, except for up-quarks.
- Resulting particles have similar properties/behavior and may hide behind known ones.
- Mixed color coupling may be unobservable or represent mesons.

Creation and Annihilation

The event of coupling two different sign flavors of the same base QPAD creates an elementary particle

Decoupling the QPAD’s that form an elementary particle annihilates the particle and frees the composing QPAD’s

The creation and annihilation must obey corresponding conservation laws

Physical fields

Free primary QPAD’s

&

Secondary QPAD’s

Primary QPAD’s

All primary state function QPAD’s are linked to an eigenvector of an operator of the separable Hilbert space

The QPAD’s that represent the state function of an elementary particle are linked to an eigenvector of the particle locator operator

Non-coupled primary QPAD’s oscillate and are linked to an eigenvector of the canonical conjugate of the locator operator

Properties of primary couplings

- Location
  - Position
  - Momentum
- Coupling factor m
- Electric charge
- Color charge
- Spin
  - Fermion (half integer spin)
  - Boson (full integer spin)

Physical fields I

Static primary QPAD’s are not observable

Non-coupled primary QPAD’s oscillate and are noticeable as first category physical fields.

Second category physical fields use properties of primary couplings as their sources/drains

The two categories are fundamentally different

Physical fields II

Where the carriers that are transported by state functions are virtual sources/drains, the sources/drains of second category physical fields are actual sources/drains. They relate directly to partcles.

The virtual sources/drains are formed by tiny patches that are exchanged with the parameter space.

Physical fields III

Part of the properties give rise to dedicated fields

Property	Field	Influence
Coupling factor	gravitation	Yes
Electric charge	Maxwell	Yes
spin	Maxwell??	Yes
color	??	??

It looks as if these fields give rise to a local curvature. This is a misinterpretation.

Curvature and inertia

The Next Binding Principle

Curvature

The primary QPAD's cause a local pressure in the QPAD-sphere

On its turn that local pressure causes the local space curvature.

The Kerr-Newman metric equation gives a rough impression on how this works.
However, it uses the sources/drains of physical fields instead of the primary couplings.

Curvature and Inertia

All primary couplings affect the local curvature

Only the state function QPAD's that couple to a background QPAD will experience inertia

This also holds for anti-particles and their background anti-QPAD

Inertia versus anti-particle

Besides of the fact that all particles possess corresponding anti-particles, each state function category seems to correspond with a corresponding background QPAD, which in many cases is the conjugate of the state function QPAD.

Not all state functions seem to use their “own” sign flavor related background QPAD.

Fermions share the same (isotropic) background QPAD and anti-fermions do the same for the (isotropic) background anti-QPAD.

W and Z bosons use their “own” background QPAD, which is anisotropic.

Inertia of W and Z Bosons

The background QPAD of a W_{-} boson has the form of the state function QPAD of a W_{+} boson.

The background QPAD of a W_{+} boson has the form of the state function QPAD of a W_{-} boson.

The background QPAD of a Z boson has the form of the form of the state function QPAD of the anti-Z boson.

Effect of primary coupling

The coupling may compress or decompress the local parameter space.

Above, 56 different kinds of primary coupling are discerned.

Together with the balance equations that differ for particles and anti-particles this defines a large number of ways of how the local parameter space is affected.

Higher level coupling I

The streams of space patches that result after the primary couplings will be used in higher level interactions.

Together with the local curvature and electric charge that is caused by the primary couplings, the resulting streams determine the effect of higher order couplings.

Higher level coupling II

Hypothesis:

In these high level interactions the properties of the primary couplings are conserved

Role of secondary QPAD's

The properties that characterize primary couplings act as sources/drains of secondary QPAD's

The primary couplings are responsible for affecting the local curvature, but it looks as if the secondary QPAD's have this role

This is a false impression!

General Relativity Theory I

An equivalent theory can be developed for Palestra. Its results would be similar.

This is not worked out in detail in the HBM because the results only explain how curvature is affected.

The HBM has other methodology that goes deeper into the details of higher level coupling.

General Relativity Theory II

The Kerr-Newman metric is a solution of the theory of general relativity.
It uses spherical symmetric coordinates for its reference system.

The HBM uses this formula for computing a rough estimate of local curvature that is based on the properties of primary couplings.

Kerr-Newman

The Kerr-Newman equation describes the effects of physical fields on curvature for elementary particles as well as for black holes

The Kerr-Newman equation uses the properties that characterize the local sources/drains of the physical fields

In this way it can only give a rough description.

Kerr-Newman metric

$$c^2\,d\tau^2 = -\left(\frac{dr^2}{\Delta} + d\theta^2\right)\rho^2 + (c\,dt - \alpha\ sin^2(\theta)\ d\phi)^2\frac{\Delta}{\rho^2}$$
$$-\big((r^2+\alpha^2)\,d\phi - \alpha\,c\,dt\big)^2\ \frac{sin^2(\theta)}{\rho^2}$$

$$\rho^2 = r^2 + \alpha^2\,cos^2\,(\theta)$$
$$\Delta = r^2 - r_s\,r + \alpha^2 + r_Q^2$$

$$\alpha = \frac{J}{M\,c};\ r_s = \frac{2GM}{c^2};\ r_Q^2 = \frac{Q^2G}{4\pi\varepsilon_0 c^4}$$

Horizon Criterion

Radius of ergo region

$$r = m + \sqrt{m^2 - r_Q^2 - \alpha^2 \, cos^2(\theta)}$$

Radius of event horizon

$$r = m + \sqrt{m^2 - r_Q^2 - \alpha^2}$$

Requirement for event horizon

$$m^2 > r_Q^2 + \alpha^2$$

Otherwise the included particles stay naked.

Composite particles

Combinations of Elementary Particles

Hadrons I

Hadrons form the next level of coupling

Hadrons are composite particles

In the HBM, up-quarks are hadrons

We treat quarks as one category:

- Down-quarks
- Up-quarks

Hadrons II

Two types of hadrons exist:

- Mesons
- Baryons

Mesons are composed out of quarks and anti-quarks

Baryons are composed out of triples of quarks

Mesons might be mixed color particles

Remarks

The HBM requires different methods

Remark

Some methodologies that work in conventional complex number based physics do not work in the HBM, which is quaternion based.

Examples: covariant derivation, gauges

When choosing for the HBM, physicists must forget old tricks and learn new tricks.

Quaternionic work arounds exist

Derivation differs

In general holds for the quaternionic nabla:

$$\nabla(f\ g) \neq (\nabla f)\ g + f\ \nabla g$$

This inhibits application of covariant derivative

Part two

What the HBM does not (yet) explain

General

- The HBM takes several aspects of experimental physics for granted and uses them without explaining the reason of existence of these aspects
- The HBM does not explain some aspects that affect the model

Aspects not treated I

- The HBM does neither explain nor treat the existence of generations of elementary particles.

- Suggestion:
- Generations relate to vortexes in QPAD’s

Aspects not treated II

- The HBM does not yet treat the effect of vortexes.
- The HBM indicates what is relevant for higher order couplings, but the HBM does not yet treat them any further
- The HBM does not yet treat entropy aspects of the QPAD-sphere
- The maximum speed of the carriers in QPAD’s

Aspects not explained I

- The interpretation of equations of motion as balance equations is explained.
- However, the HBM does not explain why the elementary coupling equation is THE equation that describes primary couplings.
- In particular it is not explained why state function QPAD and coupled QPAD must be sign flavors of the same base QPAD

Aspects not explained II

- The HBM does not explain why elementary fermions and anti-fermions all couple to isotropic background QPAD's
- The HBM does not explain why elementary fermions have half-integer spin and why bosons have full integer spin

Aspects not explained III

- The HBM does not explain why elementary particles are charged electrically if and only if when the coupling switches handedness.

Part three

Unique aspects of the
Hilbert Book Model

Unique Aspects of the HBM I

- Strictly based on the axioms of Tradional Quantum Logic
- Uses Quaternionic Separable Hilbert Space
- Uses Quaternionic Probability Amplitude Distributions (QPAD’s)
- QPAD’s link Hilbert eigenvectors to a continuum eigenspace.
- Uses backround QPAD’s

Unique Aspects of the HBM II

- Applies Quaternionic Sign Selections
- Applies Sign Flavors of Quaternionic Distributions
- Replaces Spinors and Dirac Matrices by QPAD’s
- Uses QPAD’s as state functions

Unique Aspects of the HBM III

- Uses coupling of QPAD's
- Interprets equations of motion as continuity equations
- Uses Quaternionic formats of Dirac and Majorana equations
- Uses general form of these equations
- Produces representations for all known elementary particles

Unique Aspects of the HBM IV

- Computes coupling factor for all massive particles
- Relates properties of elementary particles to local curvature
- Implements inertia
- Notion of QPAD-sphere
- Notion of transport of parameter space patches
- Relates parameter space compression to local curvature

Unique Aspects of the HBM V

- Primary QPAD coupling delivers 56 elementary particles
- Higher level couplings based on resulting streams
- Properties of primary couplings are conserved
- Properties generate physical fields
- Universe-wide stepping between static status quos of the universe.
- Notion of progression counter