The Hilbert Book Model

A simple Higgsless model of fundamental physics

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Magic Wand

= QPAD + Hilbert eigenvector

QPAD's I

- A QPAD is a quaternionic probability amplitude distribution.
- QPAD's link Hilbert eigenvectors to a continuum eigenspace.
- Operators in a separable Hilbert space have a countable number of eigenvalues

Nature's Strategy

This represents the way that nature solves the dilemma that a potentially much larger set of continuous observations must fit onto a restricted set of problem carriers (the Hilbert eigenvectors)

QPAD's II

The real part of the 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.

QPAD’s III

The charge can be any property of the carrier or even the complete ensemble of properties of the carrier.

The parameter of the QPAD is a coordinate system.

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

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 patches of the parameter space

The background QPAD is an example of an isotropic source QPAD

Typical Drain QPAD

Similar to source QPAD, but the currents are reversed.

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

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

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).

An example is formed by the wave function of a neutrino

Oscillating QPAD’s

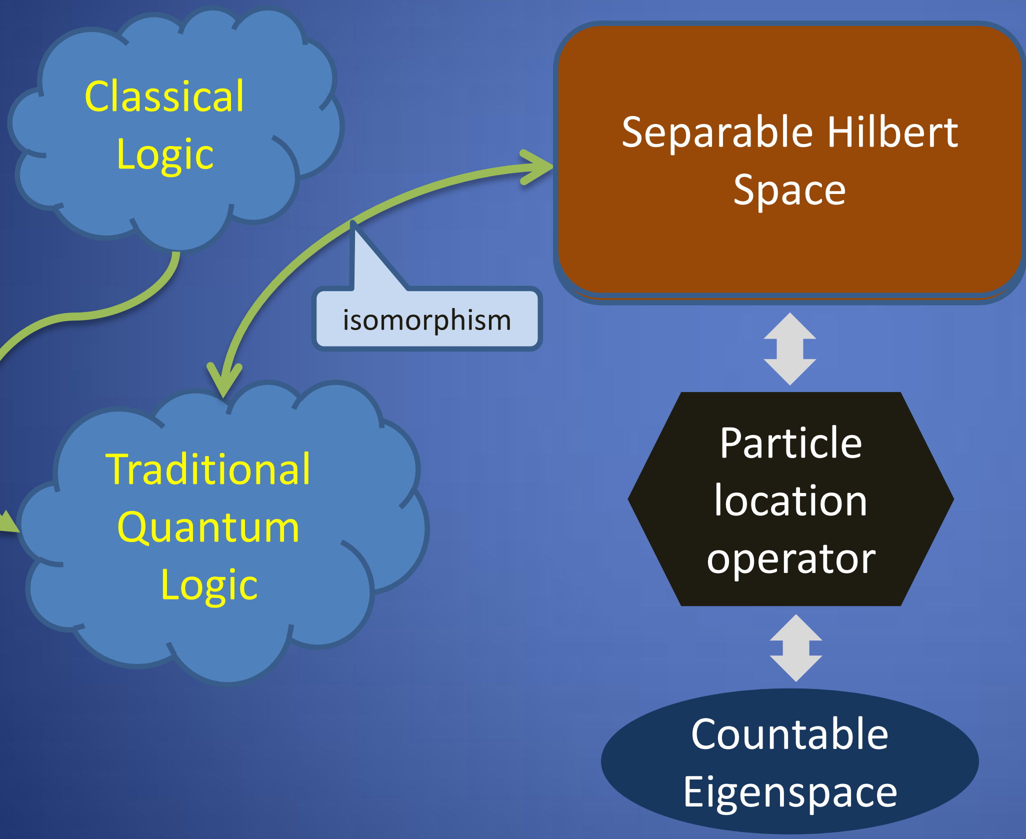
Some QPAD’s oscillate.

They are oscillating between source and drain modes.

Or they constitute plain waves.

An example is formed by a photon

First Model



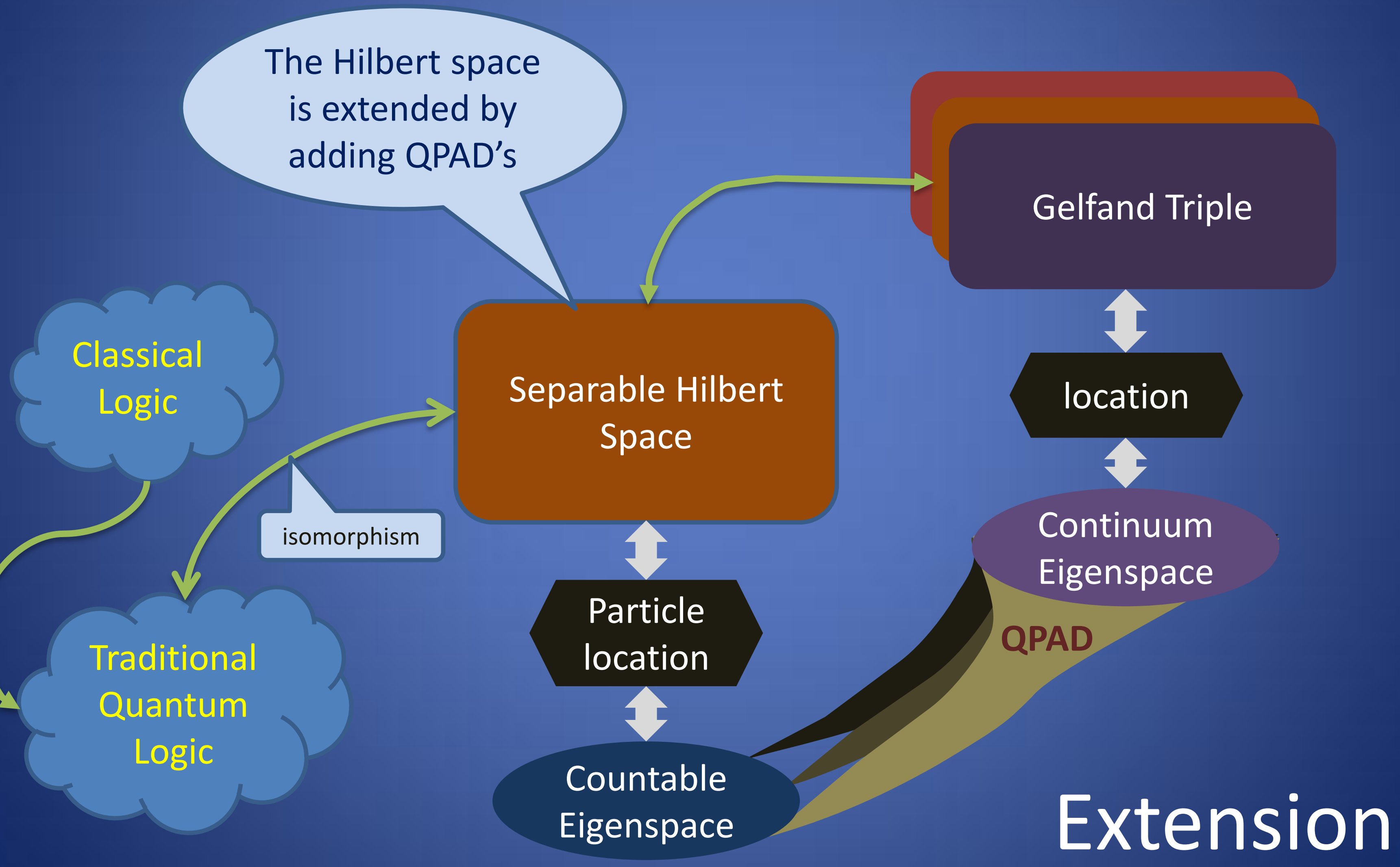
Only static status quo

&

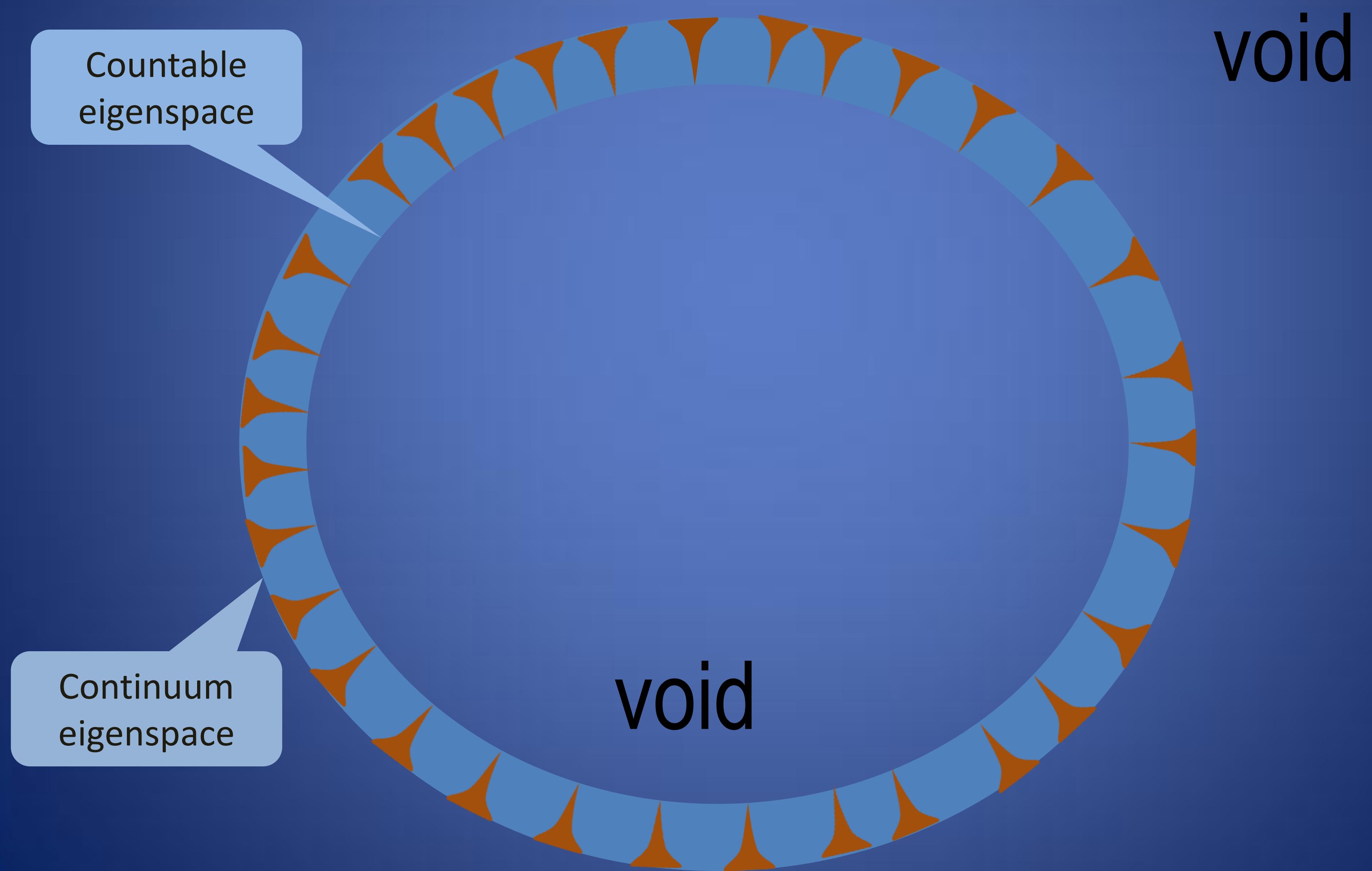
No fields

HBM Page

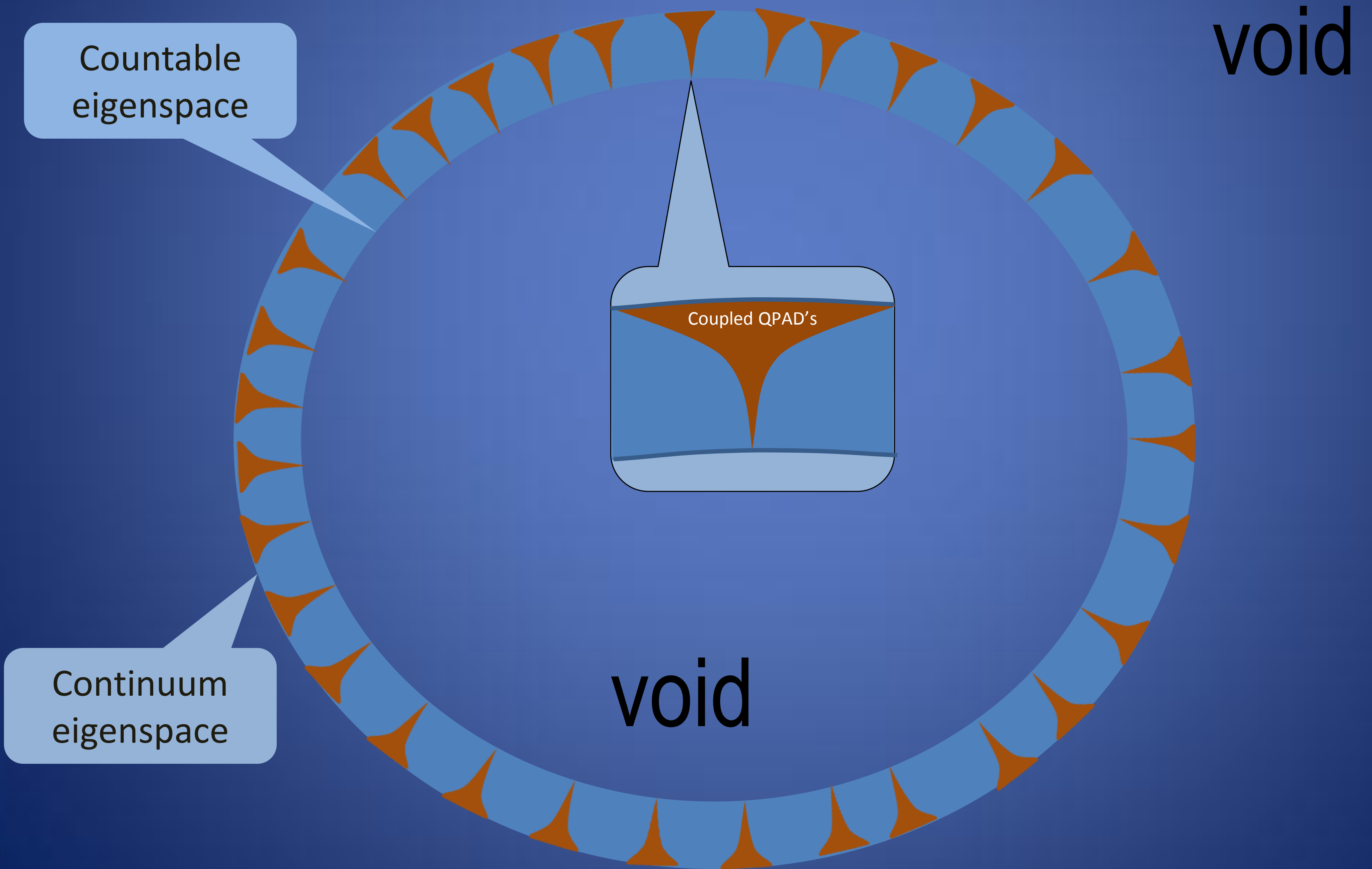
Static Status Quo of the Universe



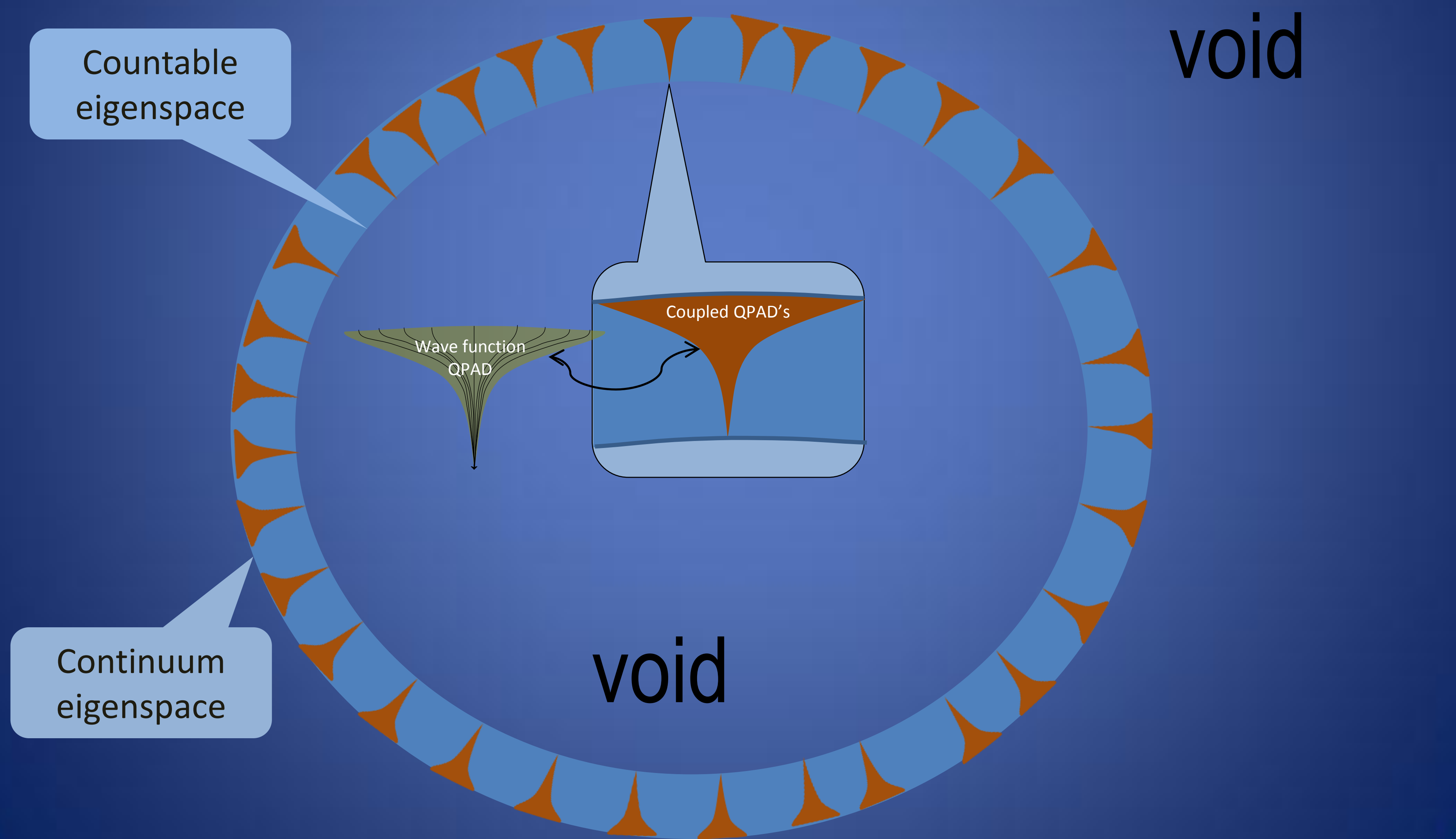
QPAD-sphere
Configuration space



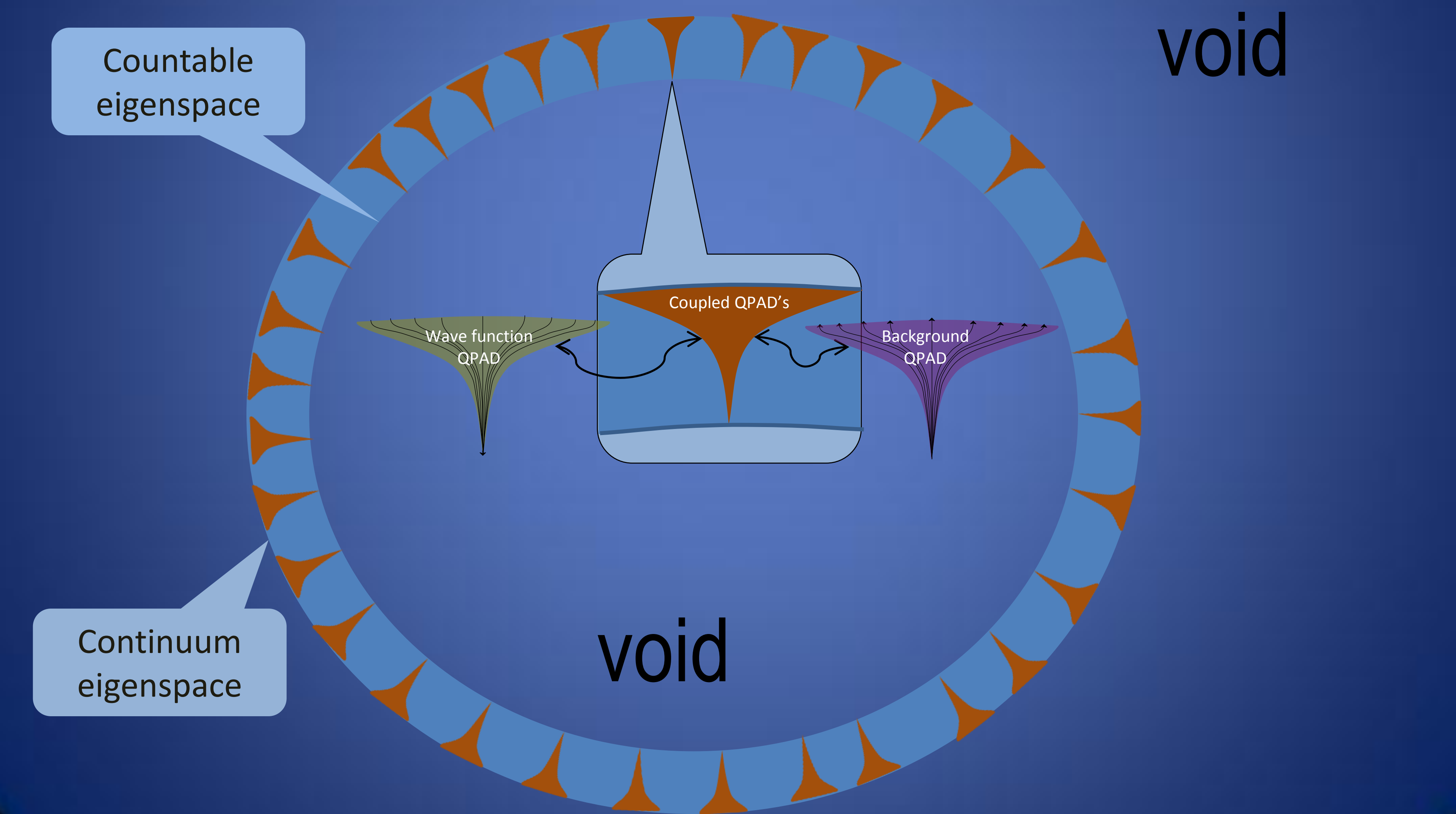
QPAD-sphere Configuration space



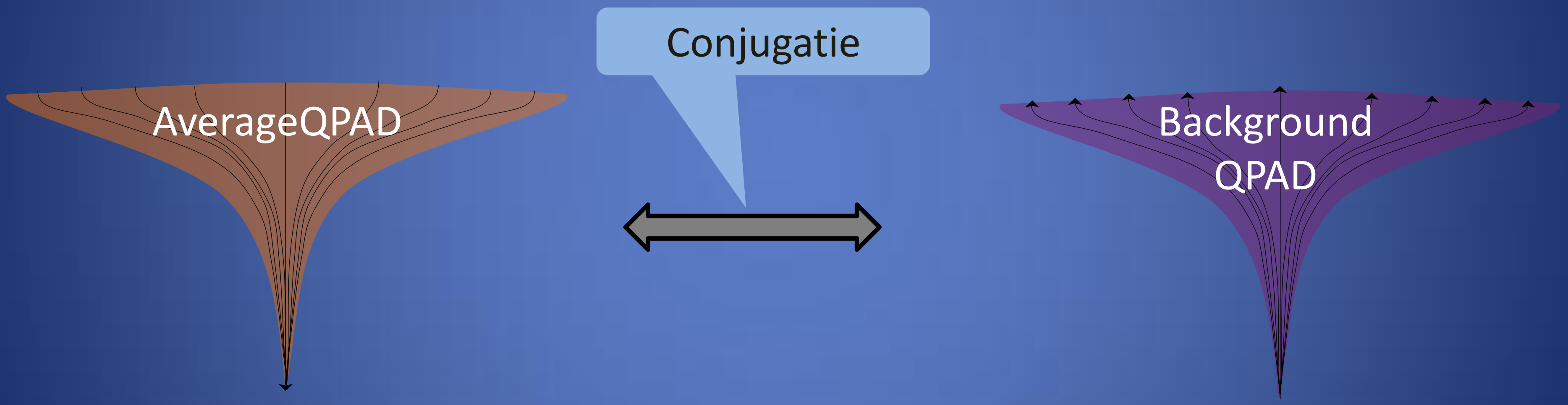
QPAD-sphere
Configuration space



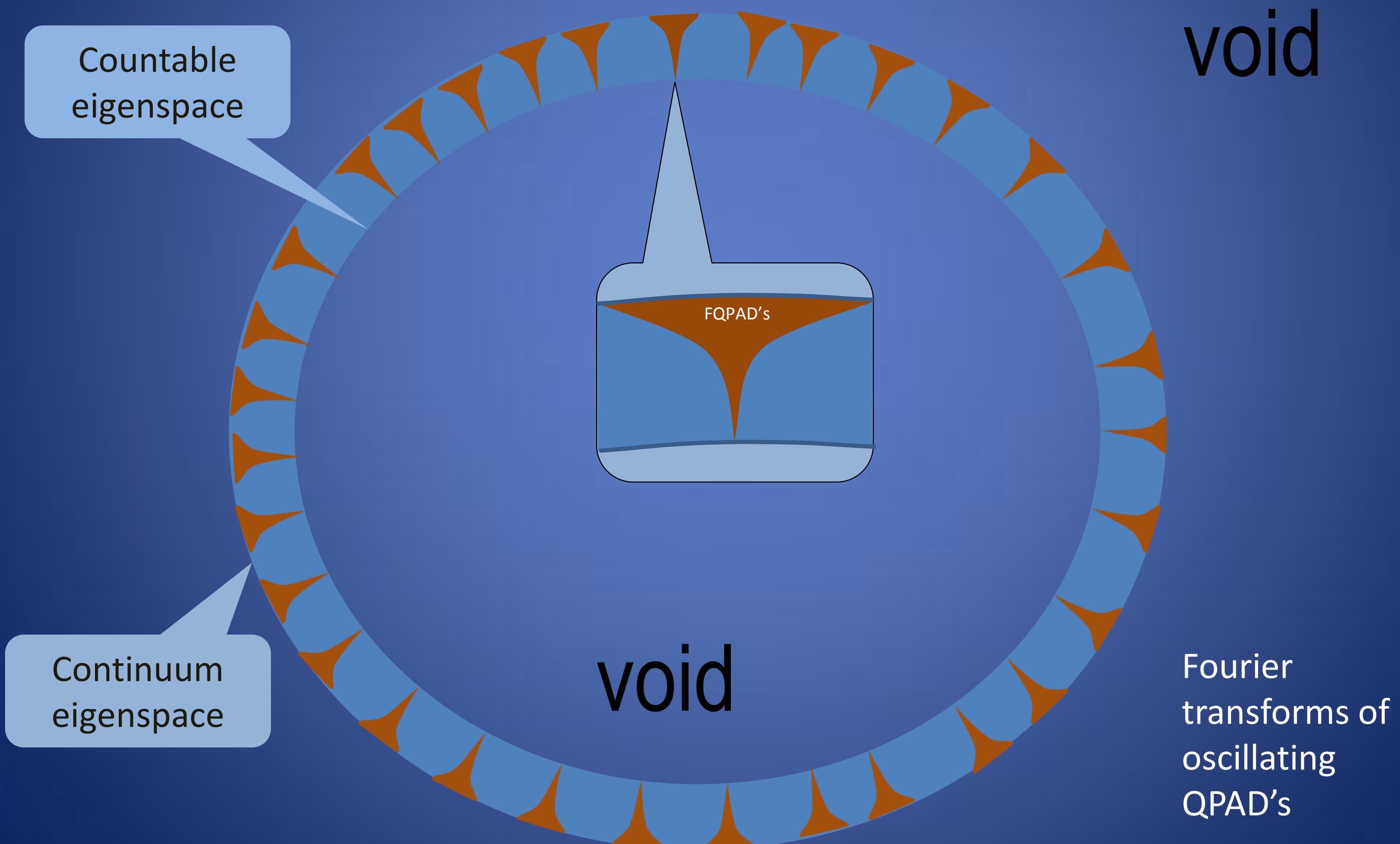
QPAD-sphere
Configuration space



Average Wave function QPAD



FQPAD-sphere
Momentum space



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).

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

Quaternionic nabla

Full diferential:

Source or drain

$$\nabla \rho = s$$

Elementary coupling

Special form of continuity equition

Quaternionic nabla

Sign flavor index

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

Wave function QPAD

Coupling factor

Coupled QPAD

Anti-particle Equation

Quaternionic nabla

Sign flavor index

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

Wave 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

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

Wave 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

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

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

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

Positive real number

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

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

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

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

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

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

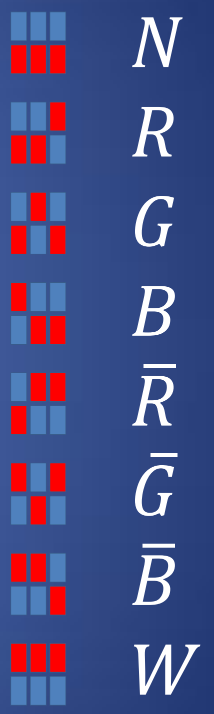
$$\boldsymbol{E} = -\boldsymbol{\nabla} \psi_0^x - \nabla_0 \boldsymbol{\psi}^x = \boldsymbol{\mathfrak{E}} - \nabla_0 \boldsymbol{\psi}^x$$

Sign selections

Quaternions allow four independent sign selections

- Conjugation
- Reflection (3 directions, colors)

Together they constitute eight mixed sign selections



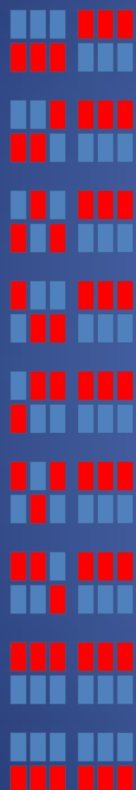
Sign flavors

Quaternionic distributions exist in eight different sign flavors

Sign flavors refer to the sign flavor of the parameter space

Elementary couplings couple sign flavors of the same QPAD

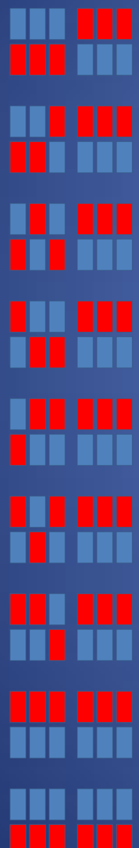
Elementary couplings



# switches	Handedness	Charge	F/B	Color	m	type
-3	Switched					
-2	Same					
-2	Same					
-2	Same					
-1	Switched					
-1	Switched					
-1	Switched					
0	0					
0	0					

What are these?

Elementary couplings



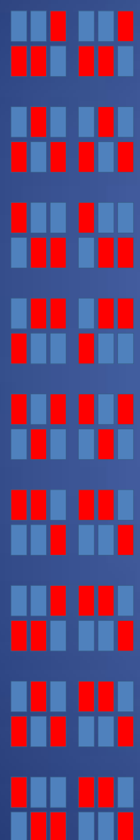
# switches	Handedness	Charge	F/B	Color	m	type
-3	Switched	-e	Fermion	N	>0	Elec-tron
-2	Same	0	Fermion	R	>0	Neu-trino
-2	Same	0	Fermion	G	>0	Neu-trino
-2	Same	0	Fermion	B	>0	Neu-trino
-1	Switched	-1/3 e	Fermion	$\bar{B}$	>0	d quark
-1	Switched	-1/3 e	Fermion	$\bar{G}$	>0	d quark
-1	Switched	-1/3 e	Fermion	$\bar{R}$	>0	d quark
1	0	0	Boson	W	0	Pho-ton
1	0	0	Boson	N	0	Pho-ton

Guessing types

Guessing the Rules

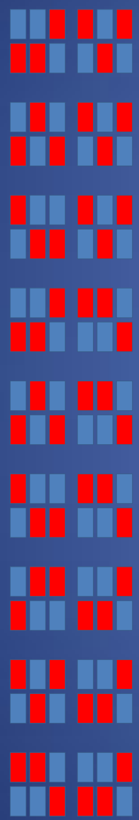
- If handedness is the same, then no charge
- Else, # switches determines charge
- Fermions are coupled to background QPAD
- Anisotropic conditions define a direction dependent color charge

Promising Couplings I



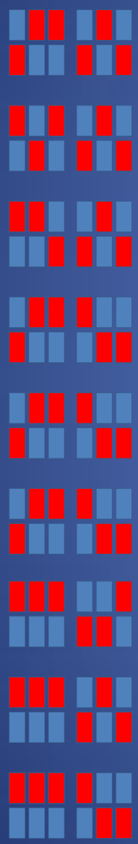
# switches	Handedness	Charge	F/B	Color	m	type
0	0	0	Boson	R	0	Glu-on
0	0	0	Boson	G	0	Glu-on
0	0	0	Boson	B	0	Glu-on
0	0	0	Boson	$\bar{B}$	0	Glu-on
0	0	0	Boson	$\bar{G}$	0	Glu-on
0	0	0	Boson	$\bar{R}$	0	Glu-on
-3	Switched	-e	Boson	$R\bar{R}$	>0	W_-
-3	Switched	-e	Boson	G$\bar{R}$	>0	W_-
-3	Switched	-e	Boson	$B\bar{R}$	>0	W_-

Promising Couplings II



# switches	Handedness	Charge	F/B	Color	m	type
-3	Switched	-e	Boson	$R\bar{G}$	>0	W_-
-3	Switched	-e	Boson	$G\bar{G}$	>0	W_-
-3	Switched	-e	Boson	$B\bar{G}$	>0	W_-
-3	Switched	-e	Boson	$R\bar{B}$	>0	W_-
-3	Switched	-e	Boson	$G\bar{B}$	>0	W_-
-3	Switched	-e	Boson	$B\bar{B}$	>0	W_-
3	Switched	e	Boson	$\bar{B}R$	>0	W_+
3	Switched	e	Boson	$\bar{G}R$	>0	W_+
3	Switched	e	Boson	$\bar{R}R$	>0	W_+

Promising Couplings III



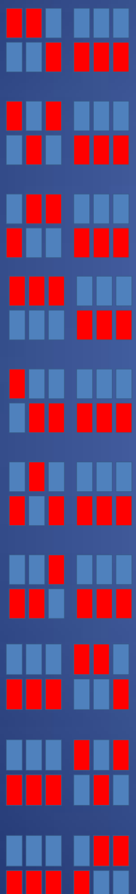
# switches	Handedness	Charge	F/B	Color	m	type
3	Switched	e	Boson	$\bar{R}G$	>0	W_+
3	Switched	e	Boson	$\bar{G}G$	>0	W_+
3	Switched	e	Boson	$\bar{B}G$	>0	W_+
3	Switched	e	Boson	$\bar{B}B$	>0	W_+
3	Switched	e	Boson	$\bar{G}B$	>0	W_+
3	Switched	e	Boson	$\bar{R}B$	>0	W_+
2	Same	0	Boson	WR	>0	Z
2	Same	0	Boson	WG	>0	Z
2	Same	0	Boson	WB	>0	Z

Summary of Results

64 different sign flavor pairs exist.

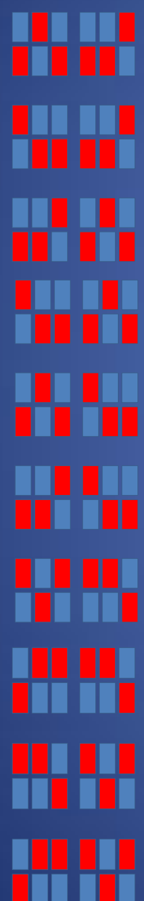
- We discovered potential representations for all known elementary particles.
- However, the scheme ***cannot*** provide up-quarks
- Anti-particles extend this list. The anti-particles are accompanied by shadow particles.
- W_+ bosons are the anti-particle shadows of W_- bosons.

Other Couplings



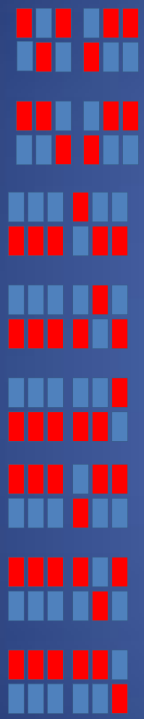
# switches	Handedness	What?
2	Same	Shadow anti-neutrino
2	Same	Shadow anti-neutrino
2	Same	Shadow anti-neutrino
3	Switched	Shadow positron
2	Switched	Shadow anti-d-quark
2	Switched	Shadow anti-d-quark
2	Switched	Shadow anti-d-quark
2	Same	Shadow anti-Z
2	Same	Shadow anti Z
2	Same	Shadow anti Z

Mixed Colors



# switches	Handedness	What?
0	Same	Mixed
0	Same	Mixed
0	Same	Mixed
0	Same	Mixed
0	Same	Mixed
0	Same	Mixed
0	Same	Mixed
0	Same	Mixed
0	Same	Mixed
0	Same	Mixed

Mixed /exchanged



# switches	Handedness	What?
0	Same	Mixed
0	Same	Mixed
-1	Switched	d-quark-like
-1	Switched	d-quark-like
-1	Switched	d-quark-like
1	Switched	d-quark-like
1	Switched	d-quark-like
1	Switched	d-quark-like

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 $m = 0$

Properties

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

Physical fields

Part of the properties give rise to dedicated fields

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

These fields give rise to a local curvature

Curvature

The 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 an impression on how this works

Part two

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 continuum eigenspace.
- Uses backround QPAD

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 wave functions

Unique Aspects of the HBM IV

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

Unique Aspects of the HBM V

- Computes coupling factor for all massive particles
- Relates properties of elementary particles to local curvature
- Notion of QPAD-sphere
- Notion of transport of parameter space patches
- Universe-wide stepping
- Notion of progression counter