Quaternionic physics

How to use **Quaternionic Distributions** and **Quaternionic Probability Amplitude Distributions**

The HBM is a quaternionic model

- The HBM concerns quaternionic physics rather than complex physics.
- The peculiarities of the quaternionic Hilbert model are supposed to bubble down to the complex Hilbert space model and to the real Hilbert space model
- The complex Hilbert space model is considered as an abstraction of the quaternionic Hilbert space model
 - This can only be done properly in the right circumstances

Continuous

Quaternionic Distributions

Quaternions

$$a = a_0 + a$$

$$c = ab = a_0b_0 - \langle a, b \rangle + a_0b + b_0a + a \times b$$

- Quaternionic distributions
 - Differential equation

$$\nabla f = \nabla_0 f_0 - \langle \nabla, f \rangle + \nabla_0 f + \nabla b_0 + \nabla \times h$$

Differential Coupling <u>Continuity</u>

equation

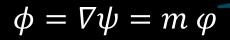
Two

equations

 $\begin{cases} g_0 = \nabla_0 f_0 - \langle \nabla, f \rangle \\ \mathbf{g} = \nabla_0 f + \nabla b_0 + \nabla \times \mathbf{b} \end{cases}$

Three kinds

g =



Field equations

- $\phi = \nabla \psi$
 - $\phi_0 = \nabla_0 \psi_0 \langle \nabla, \psi \rangle$
 - $\boldsymbol{\phi} = \nabla_0 \psi + \nabla \psi_0 + \nabla \times \psi$

Spin of a field: $\boldsymbol{\Sigma}_{field} = \int_{V} \boldsymbol{\mathfrak{E}} \times \boldsymbol{\psi} \, dV$

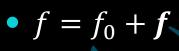
- $\mathfrak{E} \equiv \nabla_0 \boldsymbol{\psi} + \boldsymbol{\nabla} \psi_0$
- $\mathfrak{B} \equiv \nabla \times \psi$
- $\boldsymbol{\phi} = \mathfrak{E} + \mathfrak{B}$

•
$$E \equiv |\phi| = \sqrt{\phi_0 \phi_0 + \langle \phi, \phi \rangle}$$

= $\sqrt{\phi_0 \phi_0 + \langle \mathfrak{E}, \mathfrak{E} \rangle + \langle \mathfrak{B}, \mathfrak{B} \rangle + 2 \langle \mathfrak{E}, \mathfrak{B} \rangle}$ Is zero ?

QPAD's

Quaternionic distribution



field



Quaternionic Probability Amplitude Distribution

$$\boldsymbol{\psi} = \boldsymbol{\psi}_0 + \boldsymbol{\psi} = \rho_0 + \rho_0 \boldsymbol{u}$$

Density distribution

Current density distribution

Coupling equation Differential $\phi = \nabla \psi = m \varphi$ $|\psi| = |\varphi|$ Integral $\int_{\mathcal{W}} |\psi|^2 \, dV = \int_{\mathcal{W}} |\varphi|^2 \, dV = 1$ $\int_{U} |\phi|^2 \, dV = m^2$

 ψ and φ are normalized

m = total energy = rest mass + kinetic energy

Flat space

Coupling in Fourier space

 $\begin{aligned} \nabla \psi &= \phi = m \, \varphi \\ \mathcal{M} \tilde{\psi} &= \tilde{\phi} = m \, \tilde{\varphi} \\ \langle \tilde{\psi} | \mathcal{M} \tilde{\psi} \rangle &= m \, \langle \tilde{\psi} | \tilde{\varphi} \rangle \end{aligned}$

$$\begin{aligned} \mathcal{M} &= \mathcal{M}_0 + \mathbf{M} \\ \mathcal{M}_0 \tilde{\psi}_0 - \langle \mathbf{M}, \widetilde{\mathbf{\psi}} \rangle &= m \ \tilde{\varphi}_0 \\ \mathcal{M}_0 \mathbf{\psi} + \mathbf{M} \tilde{\psi}_0 + \mathbf{M} \times \widetilde{\mathbf{\psi}} &= m \ \widetilde{\boldsymbol{\varphi}} \end{aligned}$$

$$\int_{\widetilde{V}} \widetilde{\phi}^2 \ d\widetilde{V} = \int_{\widetilde{V}} \left(\widetilde{\mathcal{M}\psi} \right)^2 \ d\widetilde{V} = m^2$$

In general $|\tilde{\psi}\rangle$ is not an eigenfunction of operator \mathcal{M} . That is only true when $|\tilde{\psi}\rangle$

That is only true when $|\tilde{\psi}\rangle$ and $|\tilde{\varphi}\rangle$ are equal. For elementary particles they are equal apart from their difference in discrete symmetry.

Dirac equation

Flat space

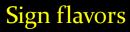
$$\nabla_0[\psi] + \nabla \alpha[\psi] = m\beta[\psi]$$

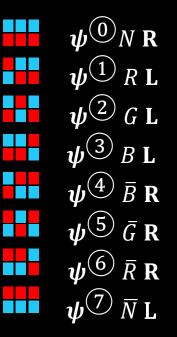
- Spinor $[\psi]$
- Dirac matrices α , β
 - $\nabla_0 \psi_R + \nabla \psi_R = m \psi_L$
 - $\nabla_0 \psi_L \nabla \psi_L = m \psi_R$
- In quaternion format
 - $\nabla \psi = m \psi^*$ -
 - $abla^*\psi^* = m\psi$

$$\psi_R = \psi_L^* = \psi_0 + \boldsymbol{\psi}$$

Elementary particles

- Coupling equation
 - $\nabla \psi^x = m \, \psi^y$
 - $(\nabla \psi^x)^* = m \ (\psi^y)^*$
- Coupling occurs between pairs
 - $\{\psi^x,\psi^y\}$
- Colors
 - N, R, G, B, \overline{R} , \overline{G} , \overline{B} , W
- Right and left handedness
 - **R**,L





Discrete symmetries

Spin

- HYPOTHESIS : Spin relates to the fact whether the coupled Qpattern is the reference Qpattern $\psi^{(0)}$.
- Each generation has its own reference Qpattern.
- Fermions couple to the reference Qpattern.
- Fermions have half integer spin.
- Bosons have integer spin.
- The spin of a composite equals the sum of the spins of its components.

Electric charge

- HYPOTHESIS : Electric charge depends on the difference and direction of the base vectors for the Qpattern pair.
- Each sign difference stands for one third of a full electric charge.
- Further it depends on the fact whether the handedness differs.
- If the handedness differs then the sign of the count is changed as well.

Color charge

- HYPOTHESIS : Color charge is related to the direction of the anisotropy of the considered Qpattern with respect to the reference Qpattern.
- The anisotropy lays in the discrete symmetry of the imaginary part.
- The color charge of the reference Qpattern is white.
- The corresponding anti-color is black.
- The color charge of the coupled pair is determined by the colors of its members.
- All composite particles are black or white.
- The neutral colors black and white correspond to isotropic Qpatterns.
- Currently, color charge cannot be measured.
- In the Standard Model the existence of color charge is derived via the Pauli principle.

Total energy

- Mass is related to the number of involved Qpatches.
- It is directly related to the square root of the volume integral of the square of the local field energy *E*.
- Any internal kinetic energy is included in *E*.
- The same mass rule holds for composite particles.
- The fields of the composite particles are dynamic superpositions of the fields of their components.

Leptons

Pair	s-type	e-charge	c-charge	Handed	SM Name
				ness	
$\{\psi^{(7)},\psi^{(0)}\}$	fermion	-1	Ν	LR	electron
$\{\psi^{(0)},\psi^{(7)}\}$	Anti- fermion	+1	W	RL	positron

Quarks

Pair	s-type	e-charge	c-charge	Handedness	SM Name
$\{\psi^{(1)},\psi^{(0)}\}$	fermion	-1/3	R	LR	down-quark
$\{\psi^{(0)},\psi^{(7)}\}$	Anti-fermion	+1/3	R	RL	Anti-down-quark
$\{\psi^{(2)},\psi^{(0)}\}$	fermion	-1/3	G	LR	down-quark
$\{\psi^{(5)},\psi^{(7)}\}$	Anti-fermion	+1/3	G	RL	Anti-down-quark
$\{\psi^{(3)},\psi^{(0)}\}$	fermion	-1/3	В	LR	down-quark
$\{\psi^{(4)},\psi^{(7)}\}$	Anti-fermion	+1/3	B	RL	Anti-down-quark
$\{\psi^{(4)},\psi^{(0)}\}$	fermion	+2/3	B	RR	up-quark
$\{\psi^{(3)},\psi^{(7)}\}$	Anti-fermion	-2/3	В	LL	Anti-up-quark
$\{\psi^{(5)},\psi^{(0)}\}$	fermion	+2/3	G	RR	up-quark
$\{\psi^{(2)},\psi^{(7)}\}$	Anti-fermion	-2/3	G	LL	Anti-up-quark
$\{\psi^{(0)},\psi^{(0)}\}$	fermion	+2/3	R	RR	up-quark
$\{\psi^{(1)},\psi^{(7)}\}$	Anti-fermion	-2/3	R	LL	Anti-up-quark

Reverse quarks

Pair	s-type	e-charge	c-charge	Handedness	SM Name
$\{\psi^{(0)},\psi^{(1)}\}$	fermion	+1/3	R	RL	down-r-quark
$\{\psi^{(7)},\psi^{(6)}\}$	Anti-fermion	-1/3	R	LR	Anti-down-r-quark
$\{\psi^{\textcircled{0}},\psi^{\textcircled{2}}\}$	fermion	+1/3	G	RL	down-r-quark
$\{\psi^{(7)},\psi^{(5)}\}$	Anti-fermion	-1/3	G	LR	Anti-down-r-quark
$\{\psi^{(0)},\psi^{(3)}\}$	fermion	+1/3	В	RL	down-r-quark
$\{\psi^{(7)},\psi^{(4)}\}$	Anti-fermion	-1/3	B	LR	Anti-down-r_quark
$\{\psi^{(0)},\psi^{(4)}\}$	fermion	-2/3	B	RR	up-r-quark
$\{\psi^{(7)},\psi^{(3)}\}$	Anti-fermion	+2/3	В	LL	Anti-up-r-quark
$\{\psi^{\textcircled{0}},\psi^{\textcircled{5}}\}$	fermion	-2/3	G	RR	up-r-quark
$\{\psi^{(7)},\psi^{(2)}\}$	Anti-fermion	+2/3	G	LL	Anti-up-r-quark
$\{\psi^{(0)},\psi^{(6)}\}$	fermion	-2/3	R	RR	up-r-quark
$\{\psi^{(7)},\psi^{(1)}\}$	Anti-fermion	+2/3	R	LL	Anti-up-r-quark 16

W-particles

$\{\psi^{(6)},\psi^{(1)}\}$	boson	-1	RR	RL	<i>W_</i>
$\{\psi^{(1)},\psi^{(6)}\}$	Anti-boson	+1	RR	LR	W_+
$\{\psi^{(6)},\psi^{(2)}\}$	boson	-1	RG	RL	<i>W</i> _
$\{\psi^{(2)},\psi^{(6)}\}$	Anti-boson	+1	GR	LR	W_+
$\{\psi^{(6)},\psi^{(3)}\}$	boson	-1	RB	RL	<i>W</i> _
$\{\psi^{(3)},\psi^{(6)}\}$	Anti-boson	+1	BR	LR	<i>W</i> +
$\{\psi^{(5)},\psi^{(1)}\}$	boson	-1	GG	RL	<i>W</i> _
$\{\psi^{(1)},\psi^{(5)}\}$	Anti-boson	+1	GG	LR	<i>W</i> ₊
$\{\psi^{(5)},\psi^{(2)}\}$	boson	-1	GG	RL	<i>W</i> _
$\{\psi^{(2)},\psi^{(5)}\}$	Anti-boson	+1	GG	LR	<i>W</i> ₊
$\{\psi^{(5)},\psi^{(3)}\}$	boson	-1	GΒ	RL	<i>W</i> _
$\{\psi^{(3)},\psi^{(5)}\}$	Anti-boson	+1	BG	LR	<i>W</i> ₊
$\{\psi^{(4)},\psi^{(1)}\}$	boson	-1	BR	RL	<i>W</i> _
$\{\psi^{(1)},\psi^{(4)}\}$	Anti-boson	+1	RB	LR	<i>W</i> +
$\{\psi^{(4)},\psi^{(2)}\}$	boson	-1	BG	RL	<i>W</i> _
$\{\psi^{(2)},\psi^{(4)}\}$	Anti-boson	+1	GB	LR	<i>W</i> ₊
$\{\psi^{(4)},\psi^{(3)}\}$	boson	-1	BB	RL	<i>W</i> _
$\{\psi^{(3)},\psi^{(4)}\}$	Anti-boson	+1	BB	LR	<i>W</i> +

Z-particles

Pair	s-type	e-charge	c-charge	Handedness	SM Name
	boson		GR	LL	Z
$\{\psi^{(2)},\psi^{(1)}\}$	DOSOII	0	GR		
$\{\psi^{(5)},\psi^{(6)}\}$	Anti-boson	0	GR	RR	Z
$\{\psi^{(3)},\psi^{(1)}\}$	boson	0	BR	LL	Z
$\{\psi^{(4)},\psi^{(6)}\}$	Anti-boson	0	RB	RR	Z
$\{\psi^{(3)},\psi^{(2)}\}$	boson	0	BR	LL	Z
$\{\psi^{(4)},\psi^{(5)}\}$	Anti-boson	0	RB	RR	Z
$\{\psi^{(1)},\psi^{(2)}\}$	boson	0	RG	LL	Z
$\{\psi^{(6)},\psi^{(5)}\}$	Anti-boson	0	RG	RR	Z
$\{\psi^{(1)},\psi^{(3)}\}$	boson	0	RB	LL	Z
$\{\psi^{(6)},\psi^{(4)}\}$	Anti-boson	0	RB	RR	Z
$\{\psi^{(2)},\psi^{(3)}\}$	boson	0	RB	LL	Z
$\{\psi^{(5)},\psi^{(4)}\}$	Anti-boson	0	RB	RR	Z 18

Neutrinos

type	s-type	e-charge	c-charge	Handedness	SM Name
{\vvvv,\vvvv}}	fermion	0	NN	RR	neutrino
{ $\psi^{(0)},\psi^{(0)}$ }	Anti-fermion	0	WW	LL	neutrino
{\$\psi_{\sty}{\psi_{\psi_{\sty}{\set \beta}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}}	boson?	0	RR	RR	neutrino
$\{\psi^{(1)},\psi^{(1)}\}$	Anti- boson?	0	RR	LL	neutrino
{\varphi^(5)}, \varphi^(5)}	boson?	Ο	GG	RR	neutrino
{\varphi^2, \varphi^2}	Anti- boson?	Ο	GG	LL	neutrino
$\{\psi^{(4)},\psi^{(4)}\}$	boson?	0	BB	RR	neutrino
{ $\psi^{(3)},\psi^{(3)}$ }	Anti- boson?	0	BB	LL	neutrino 19

Color confinement

The *color confinement rule* forbids the generation of individual particles that have non-neutral color charge

Color confinement

 Color confinement forbids the generation of individual quarks

- Quarks can appear in hadrons
- Color confinement blocks observation of gluons

Photons & gluons

type	s-type	e-charge	c-charge	Handedness	SM Name
{\varphi^{(7)}}	boson	0	Ν	R	photon
{ \ \ \ 0 }	boson	0	W	L	photon
{ \$ \$\$	boson	0	R	R	gluon
$\{\psi^{(1)}\}$	boson	0	R	L	gluon
{\varphi^{(5)}}	boson	0	G	R	gluon
{\varphi^2}	boson	0	G	L	gluon
{\varphi^{(4)}}	boson	0	B	R	gluon
{\\$\\$3}}	boson	0	В	L	gluon 22

Photons & gluons

Photons and gluons are NOT particles

 Ultra-high frequency waves are constituted by wave fronts that at every progression step are emitted by elementary particles

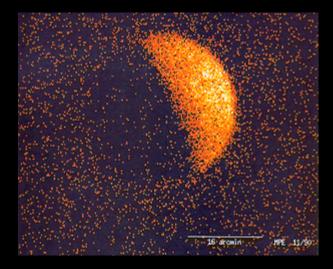
 Photons and gluons are modulations of ultra-high frequency carrier waves.

Quanta

The noise of low dose imaging

Low dose X-ray imaging Film of cold cathode emission

Shot noise



Low dose X-ray image of the moon

Shot noise



Navigate

To Logic Systems slides: http://vixra.org/abs/1302.0122

To start of Hilbert Book slides: <u>http://vixra.org/abs/1302.0125</u>

To "Physics of the Hilbert Book Model" <u>http://vixra.org/abs/1307.0106</u>