Steps to the Hilbert Book Model

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Summary

The Hilbert Book Model is a purely mathematical model of physical reality that starts with a solid foundation

Steps

A mathematically guided tour through the essentials of physics.

Step 1

Select the orthomodular lattice as the foundation of the model.

Step 2

The orthomodular lattice emerges into a separable Hilbert space

Step 3

Hilbert spaces can only cope with number systems that are associative division rings.

Select the quaternionic number system. It is the most versatile associative division ring.

Step 4

Quaternionic number systems exist in many versions that differ in the way that Cartesian and polar coordinate systems sequence their elements. The selected version determines the symmetry of the Hilbert space.

Step 5

Multiple separable Hilbert systems can share the same underlying vector space.

This restricts the versions of the quaternionic number systems, such that coordinate axes of the Cartesian coordinate systems are parallel.

Step 6

All separable Hilbert spaces own a private parameter space that applies the selected version of the number system. A dedicated normal operator manages this parameter space as its eigenspace. This opens the possibility to define a category of normal operators that apply a function to specify a sampled continuum as their eigenspace.

Step 7

One infinite dimensional separable Hilbert space acts as the background platform and manages the background parameter space.

Step 8

All other separable Hilbert spaces float with the geometric center of their parameter space over the background parameter space. Symmetry related properties of the floating Hilbert spaces are determined relative to the background parameter space.

Step 9
On each floating platform resides an elementary particle.

Step 10
A private stochastic process that owns a characteristic function generates the hop landing locations of the particle and archives them as a combination of a scalar time stamp and a three-dimensional location in a quaternionic eigenvalue of a dedicated footprint operator, which resides in the floating separable Hilbert space. After sequencing the timestamps, the eigenspace of the footprint operator tells the complete life-story of the elementary particle.

Step 11
The stochastic process recurrently regenerates a hop landing location swarm. A location density distribution that equals the Fourier transform of the characteristic function describes this hop landing location swarm. The location density distribution equals the squared modulus of the wavefunction of the elementary particle.

Step 12
The background separable Hilbert space owns a non-separable Hilbert space that embeds its separable companion. This step combines Hilbert space operator technology with quaternionic function theory, quaternionic differential calculus, and quaternionic integral calculus.

Step 13
A dedicated operator in this non-separable Hilbert space manages a continuum eigenspace that acts as the dynamic field, which represents the universe that exists always and everywhere in the model.

Step 14
The life story of each elementary particle describes the ongoing embedding of the eigenspace of the footprint operator into the background platform. Disparity of symmetries cause field excitations in the universe field that may temporarily deform this embedding field and will persistently expand the universe. Spherical pulse responses act as spherical shock fronts that over time integrate into the Green's function of the field.

Step 15
Fermion elementary particles act as elementary modules. Together they constitute all modules that exist in the universe. Some of these modules constitute modular systems.

Step 16
All composite modules own a private stochastic process that own a characteristic function, which controls the composition of the composite module. The characteristic function equals a dynamic superposition of the characteristic functions of the components. The superposition coefficients act as displacement generators that determine the internal locations of the components.

Step 17
All modules and modular systems add a displacement generator to their characteristic function. This gauge factor determines the movement of the module as a single unit.

Step 18
The components of compound modules share the geometric center of their platforms. Thus, these components float as one unit. Chemists and physicists call them atoms or atomic ions.

Step 19

Molecules are conglomerates of atomic ions that share each other's electrons.

Step 20

One-dimensional shock fronts exchange a standard amount of energy with platforms of elementary particles. Photons are strings of equidistant one-dimensional shock fronts that obey E = h ν. Atoms and ions show their signature during emission or absorption of photons.

Physical reality poses restrictions to our fantasies

Physical reality poses many serious restrictions on how its primal structure and behavior can be extended to a more complicated system.
This starts by its foundation. The foundation is a relational structure. This is a set that restricts the kind of relations between its elements which the set will tolerate. Mathematicians call this specific relational structure an orthomodular lattice. Lattices are formally defined relational structures.
It is known that the orthomodular lattice emerges into a separable Hilbert space. This extension adds a vector space and a number system to the orthomodular lattice. The set of closed subspaces of the Hilbert space shows the relational structure of an orthomodular lattice. The Hilbert space applies its inner product to specify this closure. This restricts the kinds of number systems that can be used to specify this inner product. These number systems must be associative division rings. In a division ring each non-zero element must have a unique inverse. This limits the number systems to the real numbers, the complex numbers, or the quaternions. Depending on their dimension these number systems exist in many versions that differ in the way that Cartesian and polar coordinate systems can sequence their members.
A huge number of orthomodular lattices can share the same vector space. If this opportunity is exploited, then the versions of the number systems must be limited to Cartesian coordinate systems whose axes are in parallel. The sequencing can still be up or down. The selection restricts the number of allowed symmetries of the versions of the number system. The Hilbert space inherits this symmetry. A dedicated operator manages the selected version of the number system in its eigenspace. That eigenspace is countable. It contains the rational values of the selected version. We call this operator the reference operator. The eigenspace acts as the private parameter space of the Hilbert space. This choice enables the definition of a category of defined operators that shares the eigenvectors of the reference operator and use the target values of a selected function as their eigenvalues. In this way, these operators define a category of sampled fields.
One of the separable Hilbert spaces takes the role of the background platform. All other separable Hilbert spaces float with the geometrical center of their parameter space over the background parameter space.
If the background platform has infinite dimensions, then it owns a non-separable Hilbert space that embeds its separable partner.
This step combines Hilbert space operator technology with quaternionic function theory, quaternionic differential calculus and quaternionic integral calculus. The non-separable Hilbert space supports operators that offer a continuum eigenspace. One of these eigenspaces represents a dynamic field that exists always and everywhere.
The sketched configuration enables mathematics to apply the extended Stokes theorem to discover what source or sink is located at the geometrical center of the parameter space. These artefacts generate the symmetry related fields that represent the symmetry difference between the floating platforms and the background platform.

Dynamic fields

The model defines precisely what a dynamic field can be. It is the eigenspace of a normal operator that resides in a quaternionic non-separable Hilbert space. A quaternionic function describes the field. The private parameter space of the Hilbert space acts as the parameter space of this function. It is a flat field. Quaternionic differential and integral calculus describes the behavior of the field. Second order partial differential calculus describes the interaction between point-like artifacts and the field. All basic fields obey the same field equations.

The universe is a special field. It exists always and everywhere. It registers the embedding of all artifacts. All discrete objects that exist in the universe are constituted by field excitations of this dynamic field.

References

The Hilbert Book Model is treated in detail on “The Mathematics of Physical Reality”; http://vixra.org/abs/1904.0388 and on

https://en.wikiversity.org/wiki/Hilbert_Book_Model_Project