64 Shades of Space

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Abstract

Depending on its dimension, space that can be represented by number systems exists in many shades. The quaternionic number system provides 64 shades of space. Platforms that apply a private shape of space, float over a background platform. Modular systems of floating and combining platforms populate a universe that looks like the reality in which we live.

Quaternionic number space

Due to their four dimensions, quaternionic number systems exist in many versions that differ in the way that coordinate systems can sequence them. Cartesian coordinate systems can sequence the spatial part of quaternionic number systems in eight independent versions. In each of these versions the coordinate along the three imaginary axes runs up or down and together that creates 2^3 choices. Since also the scalar real axes can be run up or down, this number of shades increases by a factor of two. After establishing a Cartesian coordinate system, it is possible to also start a polar coordinate system. This can be done by letting the polar angle run up or down over π radians or by starting the azimuth to run up or down over 2π radians. This extends the number of shades to 64. Silently we assumed that all eight cartesian coordinate systems share the same axis system, such that apart from running up or down the axes themselves are parallel to each other. Nature appears to apply these 64 shades of space for the platforms on which it installs its elementary particles. Each different shade corresponds to a type of elementary particle. The platforms all float relative to a selected background platform as a function of the scalar part of the quaternions. This scalar part can be interpreted as a progression parameter. Thus, half of shades float forward with progression and the other half float backward with progression. The particles that float backwards are called antiparticles. The symmetries of the spatial part of the quaternions are specified in relation to the background shade. By accounting the differences in up or down direction, a short list of numbers results.

$$-3, -2, -1, 0, +1, +2, +3$$

After dividing by 3 results the list of electric charges that corresponds to the shades of the elementary particles.

$$-1, \frac{-2}{3}, \frac{-1}{3}, 0, \frac{+1}{3}, \frac{+2}{3}, +1$$

The “partially” charged particles don’t have isotropic symmetry. This is indicated by color charges. The “color” can have one of six values. The antiparticles get anti-colors. The forward floating particles get RGB colors.

The polar coordinate system relates to the spin properties of the particles. Starting with the polar angle results in half-integer spin. Starting with the azimuth results in integer spin values.

Hilbert spaces

Separable Hilbert spaces differ from a vector space in the fact that they define an inner product for each vector pair. The inner product values act as superposition coefficients in linear combinations of vectors. Each linear combination is again member of the separable Hilbert space. Linear operators describe the linear map of the Hilbert space onto itself. The linear map of a normalized vector onto itself delivers an eigenvalue and makes the vector an eigenvector. Not all normalized vectors are eigenvectors. Linear operators manage an eigenspace that is spanned by the eigenvectors. For a normal operator, the eigenvectors are mutually orthogonal and form a base of the separable Hilbert space. A special operator is the reference operator that applies the set of rational quaternions of the selected version of the quaternionic number system that specify the inner products as its eigenspace. This operator manages the private parameter space of the separable Hilbert space.

The quaternionic separable Hilbert space selects the values of its inner product from the same shade of the quaternionic number space. The quaternionic separable Hilbert spaces can act as repositories that store dynamic geometric data in the eigenspaces of normal operators. Multiple separable Hilbert spaces can share the same underlying vector space. One of these separable Hilbert spaces acts as background platform. It provides the background parameter space of the system. All other separable Hilbert space in the system float with their private parameter space over the background parameter space. Every member of this system is countable.

Restrictions

Infinite dimensional separable Hilbert spaces can only cope with number systems, whose members form a division ring. In a division ring all non-zero members own a unique inverse. This means that infinite separable Hilbert spaces can only cope with real numbers, complex numbers and quaternions.

Defined operators and fields

Together with the private parameter space, which is managed by the reference operator, and a quaternionic function, a category of defined operators can be generated. The defined operator applies the eigenvectors of the reference operator and the corresponding parameter values to create new eigenvalues that together with the corresponding target values of the function form the eigenspace of the defined operator. This eigenspace is a sampled continuum that represents a field that is described by the quaternionic function. The parameter space can be considered as representing a flat continuum.

Continuums

Every infinite dimensional separable Hilbert space owns a unique non-separable Hilbert space that embeds its separable companion. Operators in this non-separable Hilbert space exist that own a continuum as eigenspace. The continuum is described by a quaternionic function that applies the private parameter space of the non-separable Hilbert space. That parameter space is a flat continuum. It encloses the private parameter space of the companion separable Hilbert space.

Embedding

The companion non-separable Hilbert space of the background platform embeds that platform in a natural way. However, embedding a platform that applies a different shade of space is no straight forward operation. That embedding occurs only under very special conditions. The embedding occurs point-wise and the embedded quaternion must be colorless. This means that the symmetry differences with the background platform must be isotropic. For example, the electrons embed in the embedding continuum of the non-separable Hilbert space, but this event causes a spherical pulse response. Quarks cannot embed in this continuum and must first combine into baryons or mesons to form colorless results that can be embedded in the continuum. This phenomenon is known as color confinement. Thus, perceivable embedding must involve the creation of a spherical pulse response.

This pulse response is a spherical shock front that integrates into the Green's function of the embedding field. The Green's function owns a small spatial volume, which is added to the field, but according to the dynamics of the shock front the local deformation by the injection of this volume quickly fades away by spreading over the full field. Only a recurrently regenerated dense and coherent swarm of such pulse responses can produce a significant and persistent deformation of the embedding field. As a result, the elementary particle hops around in a stochastic hopping path. This hopping is exactly what occurs near the average location of an embedding elementary particle. The embedding is simple for electrons, but quarks must first superpose into hadrons before the superposition can deform the embedding field. Neutrinos don't break the symmetry, but quite probably cause isotropic discrepancy via the difference of the handiness of the product rule. This all bases on the idea that only isotropic triggers can cause spherical shock fronts and only spherical shock fronts can deform the embedding field.

Gravity

The stochastic hopping path forms the required dense and coherent hop landing location swarm, which a location density distribution describes. The convolution of the Green's function of the field with this location density distribution describes the resulting deformation of the embedding field. At some distance of the center of the swarm this deformation again gets the shape of the Green's function. Consequently, the deformation can be described there by the shape

$$f(r) = \frac{m}{r}$$

Where m relates to the mass of the particle and r equals the distance to the center of the hop landing location swarm. This function owns a singularity at its center. This is a false impression. If the location density distribution has the shape of a Gaussian distribution, then the function $f(r)$ has the shape of a perfectly continuous function.

$$f(r) = m\frac{ERF(r)}{r}$$

$ERF(r)$ is the well-known error function.

The factor m only relates to the mass of the particle. In fact, it is a mass capacity. It depends on the density of the swarm and on the rate at which the swarm is regenerated. As is indicated above, the deformation caused by each of the pulse responses fades away quickly and must be regenerated at an enough rate to cause a persistent deformation. A private stochastic process is responsible for the swarm density and the regeneration rate. The process is a combination of a Poisson process and a binomial process. The binomial process is implemented by a spatial point spread function that equals the location density distribution of the swarm. It equals the Fourier transform of the characteristic function of the stochastic process.

Modules

Elementary particles are elementary modules. Together they constitute all other modules that occur in the system. Some modules constitute modular systems. Also, modules are controlled by a private stochastic process and also this process owns a characteristic function. In composed modules, the characteristic function is a dynamic superposition of the characteristic functions of the components. The superposition coefficients act as displacement generators. In this way they determine the internal locations of the components. The module as a whole owns a displacement generator that attaches as a gauge factor to the characteristic function of the module. In this way the movement of every module is controlled. This also holds for elementary modules. Thus, the characteristic function of the composed modules controls the binding of its components. Besides of that it is clear that superposition occurs in Fourier space and not in configuration space.

Compound modules

Compound modules consist of a nucleus and a shell and comprise what physicists and chemists call atoms and ions. In this configuration electrons oscillate in a shell that encircles the nucleus. Solutions of the Helmholtz equation describe the oscillations of the electrons. Every participating electron must take a separate oscillation mode. The strange fact about this configuration is that this oscillation does not result in electromagnetic radiation. The explanation is that the platforms on which the electrons reside carry the electric charges and do not take part in the oscillations. Only the target location of the private stochastic process of the electron oscillates. Thus, not even the swarm oscillates. Instead, the stochastic hopping path of the electron approximately follows the oscillation path. The electron charges stay fixed near the center location of the compound module. As long as the oscillation path is closed, no energy is lost by the oscillation. However. a change of oscillation mode reveals a change in kinetic energy that is reported by the emittance or the absorption of a string of equidistant energy packages. These energy packages are one-dimensional shock fronts. The absorption is the time reversal of the emission. The location of the emission and the location of the absorption is at the center of the compound module and the emission takes a standard duration. Only in this way the emission mechanism can generate a well-defined photon that obeys the Einstein-Planck relation.

$$E = h\nu$$

Another interpretation of the absorption mechanism would require an incredible aiming precision. This indicates that fundamental behavior must be interpreted in a mathematical way, rather than in a physical way that would involve the observation of the event. The creator of the repository can see more aspects of the model than the observers can perceive.

The nucleus of the compound module is configured from hadrons, which on their turn are configured from superposed quarks. The color confinement mechanism forbids quarks to appear in isolation. They must first conglomerate in colorless hadrons before they can deform their carrier field. More in general the deformation by the components supports and enhances the binding of the components.

Stochastic hopping paths

Stochastic processes generate the hop landing locations of elementary particles that constitute their hopping path and their hop landing location swarm. The hop landings are stored in the eigenspace of the footprint operator that resides in the private separable Hilbert space that forms the platform of the elementary particle.

The stochastic processes that control the footprint of composed modules generate via their characteristic functions the oscillations of the components of the module that are internal to that module. The platforms do not join this oscillation. They merge at the geometric center of the module. However, the target centers of the stochastic processes that control the governed components oscillate within the module. So, the hopping paths are folded around the oscillation paths. This conglomerate clusters together with the platforms on the geometric center of the module. This combination moves as a single unit. Meanwhile all hop landings embed into the embedding field. Each clustering step reduces the statistical variance of the center location. While the elementary particle hops spread violently, the center of the module moves smoothly. The variance of the oscillation path depends on the mass of the participating submodule.

More details

More details are contained in "Structure of physical reality"; http://dx.doi.org/10.13140/RG.2.2.10664.26885