The Hilbert book model

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Introduction

Every time when I read an article about the phenomena, which occur far from us in the universe, I'm surprised about the attention that this Farawayistan gets compared to the phenomena in the world of the smallest. Everything that happens there is dismissed with collective names such as “quantum mechanics” and “field theory”. Rarely or never the treatise goes deeper. In this sub-nano-world spectacular images, such as appear in stories about the cosmos are not available.

What's playing?

Still, this is part of our environment is at least as interesting and mysterious as the cosmos. What makes it even more interesting is that the fundamentals of physics can largely be found in this area. This gets enforced by the growing awareness that our knowledge of these foundations contains a lot of gaps.

Quantum Theory

Quantum mechanics and the corresponding quantum field theory have been developed mainly in the beginning of the last century. This development occurred fairly violently and in many cases, scientists were already happy with a limited understanding that nevertheless brought enough usable formulas so that one could analyze quantum phenomena and could construct useful applications.

History

In the early days of quantum mechanics the approach was based on adapting equations of motion that were in use in classical mechanics. These equations

were quantified via an intuitive process. In Schrödinger's approach the time dependence is placed in the state function of the particle. The approach of Heisenberg positions the time dependence in the operators that act on the state function. This difference in approach ultimately makes no difference for the properties of the physical particles. That means that the state function and the operators only play a background game. In contrast, the properties of the particles play the foreground act. This indifference also means that time does not belong to the properties of a particle. With respect to the state functions and the operators time only plays the role of a parameter. Apparently it does not matter whether you place this role in the state functions or in the operators. This parameter characterizes the progress of the dynamics[1]. On the other hand, position belongs to the properties of a particle. This indicates a fundamental difference between the role of space and the role of time.

The biggest confusion arose when it became clear that the smallest things could behave both as a particle and as a wave package. This confusion continues because it also means that nature is unpredictable in the behavior of its smallest parts. Many are unable or unwilling to accept this fundamental property.

Clarification

Already early on in the last century some solid explanations were given. Garret Birkhoff and John von Neumann showed that nature is not complying with the laws of classical logic. Instead nature uses a logic in which exactly one of the laws is weakened when it is compared to classical logic. As in all situations where rules are weakened, this leads to a kind of anarchy. In those areas where the behavior of nature differs from classical logic, its composition is a lot more complicated. That area is the site of the very small items. Actually, that area is in its principles a lot more fascinating than the cosmos. The cosmos conforms, as far as we know, nicely to classical logic. In scientific circles the weakened logic that is mentioned here is named traditional quantum logic.

Hilbert model

Birkhoff and von Neumann went a step further. They discovered the fact that a mathematical structure, which more than a century earlier was discovered by mathematician David Hilbert, is in many respects similar to the structure of this quantum logic. This structure is a space with infinitely many dimensions. A position in this Hilbert space can be specified by using numbers. For each

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The role of time becomes clear in the paragraph about the Hilbert book.[1]

position that must be done with infinitely many numbers. Fortunately, that what is happening in the Hilbert space can also be specified with functions. Luckier wise a lot was already known about functions that suit this purpose.

Numbers

The numbers that can be used, need not be limited to the real numbers, which we use in order to measure our three dimensional living environment. Constantin Piron found that these numbers at least must be members of a so-called division ring. There are only three division rings: the real numbers, the complex numbers and the quaternions. Virtually no one still knows the quaternions. William Rowan Hamilton discovered quaternions already in the nineteenth century. They are hyper complex numbers with a one-dimensional real part and a three-dimensional imaginary part.

Hilbert operators

Here you see appear an immediate reason for our three dimensional world. It also delivers a mystery, because the structure of Einstein's space-time differs from the structure of the quaternions. However, there are more puzzles. Although the Hilbert space has an infinite number of dimensions, this infinity is countable. Countable means that in principle, a label with an ascending integer can be attached to each dimension. The set of real numbers is uncountable, but the set of rational numbers is countable and the set of rational quaternions is that too. So, to each dimension of the Hilbert space a rational quaternion can be attached. Mathematicians use the name operators for the mathematical things that can do this. The real numbers describe a continuum and the set of quaternions does that too. But the set of rational quaternions does not do this. This means that it is impossible to accurately describe smooth phenomena with the model obtained so far.

Graininess

The reality is even worse. There is increasing evidence that in its smallest form nature is grainy. So-called Planck units exist. These are unit sizes for time, place, action and entropy. It is basically impossible to measure the corresponding quantities more accurately than these Planck unit sizes indicate. It is as if within these limits the world does not exist or else, that nature steps over these regions.

GPS

Now suppose that we want to design a three-dimensional GPS system for nature by using the three-dimensional part of quaternions. This system would have to take into account the graininess of length. However, this is a great problem. A lattice consisting of a tightly packed collection of grains is afflicted with preferential directions. Such directions appear in nature in solids but they are not omnipresent in the universe. Therefore we need to find a different solution for the customized GPS system. This solution must not use multidimensional collections of grains, because that would pose the same problem.

Grain chains

A potential solution is a GPS that works with one-dimensional chains of grains. The chains represent paths. They can freely move in 3D space. There is one grain in the chain that represents the current position on this path. Now remains the problem to give each grain in the chain its own position.

In addition to the Hilbert space with countable dimension the mathematicians developed a Gelfand triple. As a kind of sandwich the two outer parts of this triple cover the previously described separable Hilbert space. Because this triple directly associates to the separable Hilbert space, this sandwich is also known as a “rigged Hilbert space”. In fact this name is incorrect because the triple is not a proper Hilbert space. Fortunately, the rigged Hilbert space has an uncountable number of dimensions and can easily deliver a GPS system that can act as a continuum background coordinate system. The grain chains also have an equivalent in this rigged Hilbert space and this fact can be used to attach a position in the background coordinate system to each of the grains of a selected chain.

Anchor Points

The grains of the chains that occupy the current position in the chain’s "path" are in fact anchor points of elementary particles. Depending on its type an elementary particle has one or more of these anchor points. According to Schiller’s strand theory[2], photons use only one anchor point and electrons have three anchor points.
Per time step the anchor point can **at the utmost** take one space step. If it does that, then it lands in the next grain of the chain. That is why the chain represents a kind of path. The ratio between space step and time step is fixed

[2] See References

and is equal to a constant c. That number equals the speed of a freely moving light particle. In each time step a photon invariably takes a space-step. It also means that no particle can go faster than such a freely moving light particle.

Fields

The chains are not allowed to move arbitrarily. There is something that ensures that the chain keeps its smooth shape. This is provided by a probability distribution that is associated with the anchor point. In fact, it's a hyper complex function whose squared modulus equals the mentioned probability distribution. This function has quaternions as its function values and accepts quaternions as a parameter. The three-dimensional imaginary part of the hyper complex parameter may indicate a position. In that case, the probability distribution gives the probability that the next grain will be located at the value of the parameter. The form of the probability distribution ensures that only minimal changes occur. The quaternionic function contributes to the local field. It is the part of the field that corresponds to the considered grain chain.

Private Fields

An elementary particle can have one or more anchor points. In this way the corresponding hyper complex functions together form the private field of the elementary particle. This private field has the same properties as the wave function of the particle. Quantum mechanical scholars use this wave function in order to describe the behavior and the properties of the elementary particle.

Together, all the private fields of particles form a joint covering field that, like the separate private fields, covers the whole Hilbert space. In our model, this joint covering field is part of the physical fields in our environment.

Field Theory

According to field theory each static field can be split in a rotation free (longitudinal) part and a solenoidal (divergence free, transverse) part. Due to the configuration of the field, this split may run along curved lines. This defines a local curvature. The curvature value can be used to define a new field. It is derived from the joined covering field. We can call that new field the curvature field. It has all the aspects of the gravitational field. We can take the part of the curvature field that belongs to a particle as its private curvature field. From this private curvature field the mass of the particle can be computed. Physicists usually apply this relationship in the reverse order.

The field model

The field model, which is applied here, differs significantly from the common field model. Usually the electromagnetic fields and the gravitational field are assumed to be independent of each other and the gravitational field is assumed to cause a curvature in the coordinate system that must be taken into account in the treatment of the electromagnetic fields.

In this new model the cause of the local curvature is laid down in the properties and the configuration of the covering field, which consists out of the superposition of all fields except the gravitational field. The covering field also contains the fields that match the wave functions of particles. The curvature field is then derived from the local curvature. In other words, in this new model the gravitational field is a derived field. This approach causes an immediate unification of field theories.

Hilbert sandwich

The Hilbert space itself has no place for fields. Each private field covers the whole Hilbert space. However, in the same manner as described above for the Gelfand triple, it is possible to expand the aforementioned sandwich with two additional layers, which respectively represent the covering field and the curvature field. Therefore, all in all, the expanded Hilbert sandwich consists of five layers.

Hilbert book

Each sandwich describes a static condition. Thus, this combination can still not describe any dynamics. This lack can be solved by putting a whole series of these sandwiches in an ordered sequence. In this way, a Hilbert book can be formed, in which each page represents a Hilbert sandwich. Glancing through this book then gives a picture of the dynamics of our universe. The page number acts as a progression step counter. This counter is not our common notion of time, but it has certainly something to do with it.

Discussion

What is described here is only a model. It is not more than a reflection of reality. The events we see in the cosmos are largely determined by the curvature field. The new GPS operator knows an outside horizon beyond which

no chains exist. That operator also has internal horizons inside of which no chains exist. We know these internal horizons as the exterior of black holes.

References

References: http://www.crypts-of-physics.eu/Cracksofphysics.pdf and http://www.motionmountain.net/research.html

In this book of Christoph Schiller, he uses the name **strand** for the equivalents of our chains. Please notice, strands are no strings! The strands model has little to do with string theory.