How gravitation works

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Abstract

Spherical shock fronts deform and expand their carrier. These excitations form the footprints of the particles.

The interaction

Gravitation is an interaction between a discrete object and a field that gets deformed by the interaction. First, we focus on the tiniest interaction. It is a pulse response. These pulse responses are solutions of one of two quaternionic second order partial wave equations.

$$\varphi = (\partial^2/\partial\tau^2 - \langle\nabla, \nabla\rangle)\, \psi$$

$$\rho = (\partial^2/\partial\tau^2 + \langle\nabla, \nabla\rangle)\, \psi$$

τ plays the role of proper time. ∇ is the nabla operator. The first equation is the quaternionic equivalent of the wave equation. The second splits into two first order partial differential equations.

$$\boldsymbol{\nabla} \equiv \{\partial/\partial x, \partial/\partial y, \partial/\partial z\}$$

$$\nabla_r \equiv \partial/\partial\tau$$

$$\phi = \phi_r + \boldsymbol{\Phi} = \nabla\psi$$

$$\equiv (\nabla_r + \boldsymbol{\nabla})(\psi_r + \boldsymbol{\psi}) = \nabla_r\psi_r - \langle\boldsymbol{\nabla}, \boldsymbol{\psi}\rangle + \boldsymbol{\nabla}\psi_r + \nabla_r\boldsymbol{\psi} \pm \boldsymbol{\nabla}\times\boldsymbol{\psi}$$

Thus ∇ works as a quaternionic multiplying operator.

$$\rho = \nabla^*\phi = (\nabla_r - \boldsymbol{\nabla})(\nabla_r + \boldsymbol{\nabla})(\psi_r + \boldsymbol{\psi}) = (\nabla_r\nabla_r + \langle\boldsymbol{\nabla}, \boldsymbol{\nabla}\rangle)(\psi_r + \boldsymbol{\psi})$$

In an otherwise free three-dimensional spatial setting, three pulse responses can occur. A one-dimensional actuator causes a one-dimensional shock front.

$$\psi = g(x\, \boldsymbol{I} \pm \tau)$$

During travel this shock front keeps its shape and its amplitude. The imaginary vector $\boldsymbol{I}$ only occurs in the solutions of the second equation. In the solutions of the first equation it equals unity.

In two dimensions a rather complex vibration occurs that is quite like the pattern when a stone is thrown into the center of a pond.

A three-dimensional actuator causes a spherical shock front.

$$\psi = g(r\, \boldsymbol{I} \pm \tau)/r$$

The spherical shock front integrates over time τ into the Green's function of the field. The Green's function results as a pulse response in the Poisson equation.

$$\rho = \langle \nabla, \nabla \rangle \psi$$

The Green's function has some volume. This volume is locally added to the volume of the field. Subsequently it spreads over the full extent of the field. Thus, the dynamic impulse response first locally deforms the field. This deformation quickly fades away. However, the volume persistently expands the volume of the field.

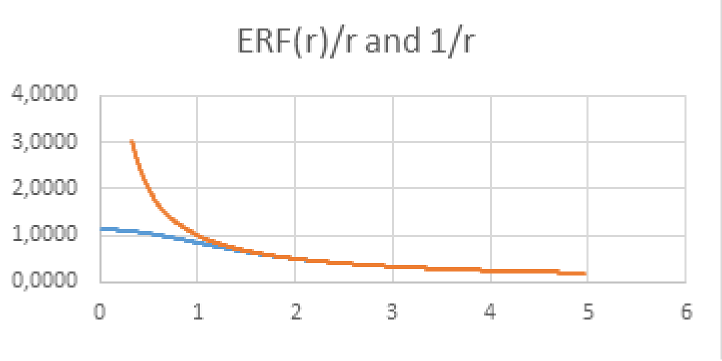
This interaction is so tiny and vanishes so quickly that the deformation cannot be perceived by any observer. This does not mean that a coherent swarm of overlapping spherical shock fronts cannot produce a significant and noticeable effect. But therefore, the overlap must occur in time and in space.

Interesting is to note that the one-dimensional shock front does not integrate into a volume. Consequently, it does not cause a deformation of its carrier.

Ensembles of spherical shock fronts

Recurrently regenerated dense and coherent swarms of hop landing locations create the overlap conditions that cause a persistent and significant deformation of the field that embeds the hop landings. A stochastic process that generates the subsequent hop landing locations in a hopping path of a point-like object can generate such condition. At every subsequent instant the process generates a new hop landing location. This location is archived in the separable Hilbert space. The swarm must be coherent. It contains a huge number of elements. This is ensured if the stochastic process owns a characteristic function. The characteristic function is the Fourier transform of the location density distribution that describes the swarm. If the characteristic function contains a gauge factor, then this factor can act as a displacement generator. It means that the hopping path is not closed. Thus, in first approximation the swarm moves coherently and smoothly as a single unit. With other words, the stochastic process with its characteristic function, the hopping path, the hop landing location swarm, and the location density distribution represent the point-like object that both hops around and moves smoothly as a single object. The object is an elementary particle. The squared modulus of its wavefunction equals the location density distribution of the swarm. The characteristic function acts as a wave package that is continuously regenerated. Usually moving wave packages disperse, but this one keeps being regenerated. Consequently, the object combines particle behavior with wave behavior. The hop landing location swarm can simulate interference patterns. The hop landing locations cause spherical shock fronts that integrate into a Green's function. The Green's function blurs the location density distribution. The result is the convolution of the Green's function with the location density distribution. This result is the contribution of the elementary particle to the local gravitation potential.

If, for example, the location density distribution of the swarm equals a Gaussian distribution, then ERF(r)/r describes the shape of the gravitation potential of the elementary module. This is a perfectly smooth function. At a small distance from the center the gravitation potential gets the familiar 1/r shape.



Back-reasoning explains that the spherical shock fronts possess a mass capacity. They contribute part of that capacity to the mass of the elementary particle. In other words, the mass of the elementary particle is proportional to the number of elements of the hop landing location swarm. The notion of mass capacity can be used to explain the existence of multiple generations of elementary particles. The part of the capacity that is used determines the generation.

Platform

This description says nothing about the fact that the process might generate different generations of elementary particles. It also says nothing about the fact that for every generation the number of elements of the swarm is fixed. The elementary particle inherits many properties of the platform on which it resides. Every elementary particle exploits a private separable Hilbert space and the platform exploits a private version of the quaternionic number system. This version determines the symmetry-related properties of the platform. For that reason, the platform features symmetry related charges that locate at the geometric center of the platform. The charges correspond to contributions to a symmetry-related field. The platform couples the gravitation field and the symmetry related fields.

Modules

Elementary particles are elementary modules. Together the elementary modules configure all other modules and some of the modules constitute the modular systems that occur in the universe.

Like with elementary modules, a stochastic process generates the footprint of modules. The characteristic function of this process equals a dynamic superposition of the characteristic functions of the components of the module. The superposition coefficients act as internal displacement generators and determine the internal positions of the components. The characteristic function of the module also contains a gauge factor that acts as a displacement generator, such that the module moves as a single unit. Therefore, the stochastic process of the module binds the components of the module. The footprint generates a swarm of spherical shock fronts that together deform the embedding field. This deformation determines the contribution of the module to the local gravitation potential.

Volume

A local deformation corresponds to a local extension of the volume of the embedding field. A global extension of the volume corresponds with expansion of the universe that the field represents. Deformations tend to fade away by spreading over the complete field. The stochastic processes must keep pumping new deformations to ensure that a deformation becomes persistent.

First inflation

This view throws an interesting light on the beginning of the history of the universe. At that instant the stochastic processes had not done any work. The balloon of the universe was still empty and the quaternionic function that describes it was equal to its parameter space. It lasted a full generation cycle of the elementary particles to pump some volume into the balloon. This pumping act already lifted the flat balloon over its full extent. From that instant on the volume grows nearly isotropically.

Stochastic control of the universe

All elementary modules reside on a private platform that is formed by a private separable Hilbert space. That Hilbert space applies a private parameter space that is formed by the elements of a version of the quaternionic number system. This version determines the symmetry related properties of the platform and the elementary particle inherits these properties. At each subsequent instance, a private stochastic process generates a new hopping path location on this platform. A characteristic function ensures the coherence of the generated hop landing location swarm. The location density distribution of the swarm equals the Fourier transform of the characteristic function and it equals the squared modulus of the wavefunction of the elementary module. The characteristic function includes a gauge factor that acts as a displacement generator. Consequently, at first approximation, the swarm moves as a single unit.

The stochastic process is the combination of a genuine Poisson process and a binomial process. The binomial process is implemented by a point spread function that equals the location density distribution of the swarm.

Together, the elementary modules constitute all modules that occur in the universe. Each composite module owns a stochastic process that possesses a characteristic function, which equals a superposition of the characteristic functions of the components of the module. The dynamic superposition coefficients act as displacement generators for the internal locations of the components. The overall characteristic function contains a gauge factor that acts as a displacement generator of the composite module. This means that the overall characteristic function binds the components of the module such that in first approximation the module moves as a single unit.

This explanation does not apply forces and force carriers. Instead it applies stochastic processes that own characteristic functions.

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