Explanation of Gravitation

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Abstract

This explanation of gravitation supports the idea that basic discrete objects are excitations of a field. The massive basic discrete objects are spherical shock fronts that carry a standard bit of mass.

1 Massive vibrations

Having mass is equivalent to having the capability to deform the carrier that embeds the owner of the mass. The amount of mass relates directly to the amount of deformation. The explanation follows in full detail below. However, the mystery of the origin of mass now shifts to the mystery behind the stochastic generators of the hopping locations of elementary particles. If the reader can accept that vibrations exist that can deform the vibrated field, then the explanation of gravitation becomes easy. If only one type of such vibration exists, then all massive objects must be constituted of superpositions of such vibrations. If more types of massive vibrations exist, then massive objects are constituted of one or more of those types. We start with investigating possible candidates.

2 Interaction of point-like actuator with the field

The wave equation is a second order partial differential equation, and it can describe the interaction between a point-like actuator and the field that gets triggered by the actuator. The second order partial differential equation can deliver different types of solutions, and these solutions can superpose. We postulate that without interactions the field stays flat. Thus, if the field vibrates or deforms, then some interaction must occur. Each kind of solution requires a corresponding actuator.

2.1 One-dimensional shock fronts

A one-dimensional one-shot actuator causes a one-dimensional shock front. During travel, the amplitude and the shape of the front do not change. Thus, in an otherwise free=flat field, these objects can travel huge distances without losing their integrity. In fact, each one-dimensional shock front that is triggered by a point-like artifact carries a standard bit of energy. It vibrates its carrier, but it does not deform it. Thus, it does not own mass.

2.2 Spherical shock fronts

A one-shot three-dimensional point-like and thus isotropic actuator causes a spherical shock front. The amplitude of the spherical shock front diminishes as $1/r$ with distance r from the location of the actuator. The front integrates into the shape of the Green's function of the field. In fact, the Green's function of the field describes the static effect of such point-like artifact. In this case, the second order partial differential equation reduces to the Poisson equation. The Green's function has volume. This volume extends the affected continuum. Locally it temporarily deforms the continuum, but this deformation quickly fades away. However, since the spherical shock front keeps spreading its volume until it covers the whole continuum, the spherical shock front permanently extends the affected continuum. The spherical shock front temporarily deforms its carrier and permanently expands it. The deformation is very small. So, in separation even sophisticated observers cannot perceive this object.

2.3 One-shot two-dimensional vibrations

Shock fronts only exist in one and three dimensions. In odd dimensions, one shot actuators trigger shock fronts, but in two dimensions a rather complicated pattern results from a corresponding one-shot trigger. A stone dropped in the middle of a pond causes a pattern that is quite like this pattern.

2.4 Waves

A periodic harmonic point-like actuator that stays at a fixed position generates spherical waves. The amplitude of spherical waves diminishes as 1/r with distance r from the location of the actuator. Spherical waves vibrate the field, but they do not integrate into a non-zero volume.

The conclusion is that only vibrations, which after integration result in a non-zero volume cause at least a temporary deformation. Spherical shock fronts that are triggered by a point-like actuator carry a standard bit of mass.

3 Stochastic actuator generators

Elementary particles hop around in a stochastic hopping path. A private stochastic process generates the hop landing locations. The process owns a characteristic function that ***ensures the coherence of the generated hop landing location swarm***.

A recurrently regenerated dense and coherent swarm of point-like one-shot triggers can produce a significant and persistent deformation of the carrier. The reason is that the temporary deformations superpose and thus overlap, such that a significant and persistent deformation results.

A location density distribution exists, which is the Fourier transform of the characteristic function of the stochastic process. It also equals the squared modulus of the wave function of the particle. The characteristic function may contain a gauge factor that acts as a displacement generator for the generated location swarm. Consequently, at first approximation, the swarm moves as a single unit.

Thus, both the hopping path and the hop landing location swarm represent the elementary particle, and the private stochastic process controls its dynamic behavior.

The deformation of the carrier equals the convolution of the Green's function of the carrier with the location density distribution of the hop landing location swarm. This result equals the gravitation potential of the elementary particle.

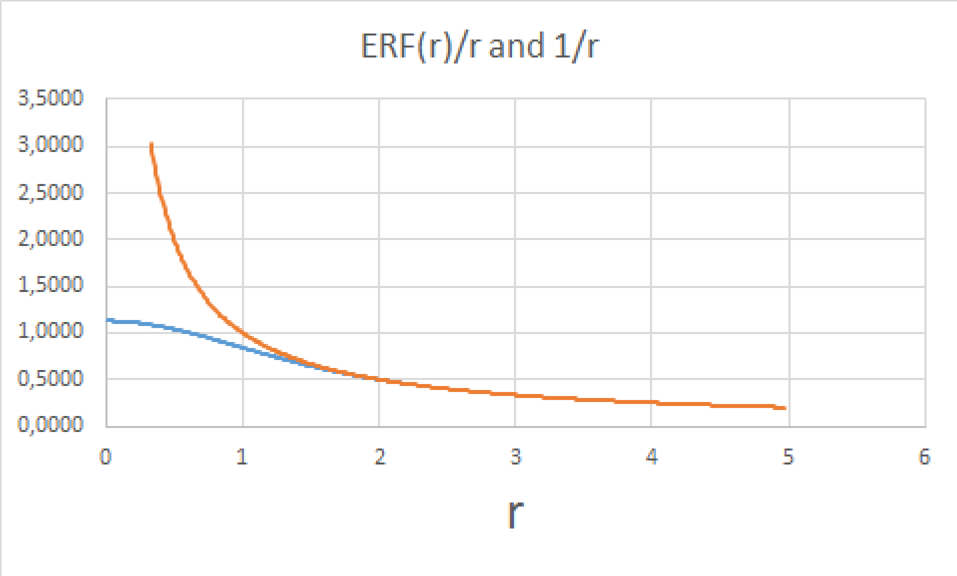
This description holds for ALL elementary particles.

3.1 Example distribution

A Gaussian location density distribution would result in a calculable gravitation potential. This results in a potential that has the form:

$$ERF(r)/r$$

This potential is a perfectly smooth function. Already at a short distance from the center, the function coincides with the Green's function of the carrier field.



A general fact is that far enough from the center the gravitation potential takes the shape of the Green's function.

4 All massive objects

Since elementary particles are elementary modules that together constitute all other modules and modules constitute modular systems, this description extends to all massive objects.

An overall stochastic process controls the generation of the hop landings that constitute the module. This process also owns a characteristic function. It is a superposition of the characteristic functions of the components of the module. The superposition coefficients act as gauge factors that control the internal locations of the components. An overall gauge factor acts as a displacement generator for the whole module. Consequently, the module moves as one unit. ***This fact also means that the overall stochastic mechanism acts as a binding actuator***.

Since the elementary modules constitute all other modules and the modular systems, the one-shot three-dimensional point-like and therefore isotropic actuator that causes a spherical shock front are all that is needed to explain the mass of observable modules.

5 Inertia

Inertia is the counteraction of the embedding field upon the acceleration of a massive object. Inertia can be comprehended if the object is supposed to embed in an otherwise flat environment in the embedding field. The reasoning starts with the condition in which the concerned object moves uniformly with speed $\mathbf{v}$ and features an isotropic gravitation potential that is described by function $f(r) \approx M/r$, which at some distance from the center is close to the shape of the Green's function. In quaternionic representation, this is a scalar field. Relative to the field this object represents a vector potential

$$\mathbf{A}(|\mathbf{r}-\mathbf{r}_c|) = \mathbf{v}\, f(|\mathbf{r}-\mathbf{r}_c|).$$

Here $\mathbf{r}_c$ represents the center location of the massive object.

In the quaternionic differential calculus differentiation is a multiplier operation. The first order partial differential equation specifies the first order change Φ of the field ψ. It contains five terms.

The subscript $_r$ indicates the real part of a quaternion. The imaginary part gets a bold type face.

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

$$\phi_r = \nabla_r\psi_r - \langle \boldsymbol{\nabla}, \boldsymbol{\Psi} \rangle$$

$$\boldsymbol{\Phi} = \boldsymbol{\nabla}\psi_r + \nabla_r \boldsymbol{\Psi} \pm \boldsymbol{\nabla} \times \boldsymbol{\Psi}$$

The overall change Φ is supposed to stay zero, and the curl $\boldsymbol{\nabla} \times \boldsymbol{\Psi}$ is supposed to be absent. So, only $\boldsymbol{\nabla}\psi_r = -\nabla_r \boldsymbol{\Psi}$ results.

$$\boldsymbol{\nabla} f(|\mathbf{r}-\mathbf{r}_c|) \approx \boldsymbol{\nabla}(M/(|\mathbf{r}-\mathbf{r}_c|)) = M\,(\mathbf{r}-\mathbf{r}_c)/\,(|\mathbf{r}-\mathbf{r}_c|)^3$$

The acceleration $\mathbf{a}$ of the object results in $\nabla_r \mathbf{v} = \mathbf{a}$. The shape of the scalar potential is not affected.

$$\nabla_r \mathbf{A}(|\mathbf{r}-\mathbf{r}_c|) = \nabla_r \{\mathbf{v}\, f(|\mathbf{r}-\mathbf{r}_c|)\} = \mathbf{a}\, M/(|\mathbf{r}-\mathbf{r}_c|)$$

To restrict the total change of the field to zero, the acceleration $\mathbf{a}$ of the object causes an extra field $\boldsymbol{\nabla}\psi_r$ which equals the gradient of the scalar potential of the object and that counteracts the acceleration.

In this extra field, the mass M will attract a second object with mass M_2 at location $\mathbf{r}$ with a force F.

$$\mathbf{F}(\mathbf{r}-\mathbf{r}_c) = M_2\, M\, (\mathbf{r}-\mathbf{r}_c)/\,(|\mathbf{r}-\mathbf{r}_c|)^3$$

6 Incoherence

It is possible that part of the hop landing location swarm escapes the control of the characteristic function of the stochastic process. In that case, the process produces some veiling glare, or the process generates some spurious hop landings. This phenomenon may become noticeable as dark matter. In fact, all shock fronts that own a point-like trigger are dark quanta. [1]

7 Mechanisms that provide mass

Now we have constructed a mechanism that competes with the Higgs mechanism. This new mechanism offers mass to all elementary particles.

The reader must decide which mechanism is false, because not both mechanisms can offer mass to the same particles.

References

[1] Rediscovered Dark Quanta; http://vixra.org/abs/1709.0150

[2] Hilbert Book Model; https://en.wikiversity.org/wiki/Hilbert_Book_Model_Project