All about mass and gravitation

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Last modified: 23 July 2019

Abstract

Gravitation and mass are explained by the fact that spherical pulse responses locally and temporarily deform the embedding field. Over time the spherical pulse response integrates into the Green's function of the field. The shape of the Green's function resembles the shape of the gravitation potential of point-like masses. At large enough distance an ensemble of massive objects acts as a single point-like mass. These ingredients explain how gravity works. The mass has a significance of its own and can characterize discrepant regions.

1 Gravitation laws

1.1 Center of mass

In a system of massive objects $p_i, i = 1, 2, 3, \ldots n$, each with mass m_i at locations r_i, the center of mass follows from

$$\sum_{i=1}^{n} m_i \left(\vec{r}_i - \vec{R}\right) = \vec{0} \tag{1.1.1}$$

Thus

$$\vec{R} = \frac{1}{M}\sum_{i=1}^{n} m_i \vec{r}_i \tag{1.1.2}$$

Where

$$M = \sum_{i=1}^{n} m_i \tag{1.1.3}$$

1.2 Newton

Newton's laws are nearly correct in nearly flat field conditions. The main formula for Newton's laws is

$$\vec{F} = m\vec{a} \tag{1.2.1}$$

Massive objects deform the field that embeds these objects, but if this effect is ignored and if the gravitation potential is a static function, and if the massive object moves uniformly, then the gravitation potential describes properly what occurs.

1.3 Gravitation potential

A massive object at a large distance acts as a point-like mass. Far from the center of mass, the gravitation potential of a group of massive particles is

$$g(r) \approx \frac{GM}{r} \tag{1.3.1}$$

This formula does not indicate that the gravitation potential can cause acceleration to a uniformly moving massive object.

1.4 The spherical pulse response

This paper considers the formulas that compute the gravitation potential from an integral over a distribution of point-like massive objects as incorrect.

In physical reality, no point-like massive objects exist. Instead, spherical pulse responses exist that behave as spherical shock fronts and integrate over time in the Green's function of the field that embeds the actuator of the pulse. The pulse response temporarily deforms the field and after injecting the volume of the Green's function of the field, the front wipes this volume over the field. Consequently, the deformation quickly fades away. The injected volume persistently expands the field.

The field equations that govern spherical pulse responses are

$$\left(\nabla_r \nabla_r \pm \left\langle \vec{\nabla}, \vec{\nabla} \right\rangle\right)\psi = 4\pi\delta\left(\vec{q} - \vec{q}'\right)\theta\left(\tau \pm \tau'\right) \tag{1.4.1}$$

Here $\theta(\tau)$ is a step function and $\delta(\vec{q})$ is a Dirac pulse response.

After the instant τ', this solution is described by

$$\psi = \frac{f\left(\left|\vec{q} - \vec{q}'\right| \pm c\left(\tau - \tau'\right)\vec{n}\right)}{\left|\vec{q} - \vec{q}'\right|} \tag{1.4.2}$$

The normalized vector $\vec{n}$ does not occur in the solutions of the wave equation form of the equation (1.4.1).

1.5 Inertia

The condition that the gravitation potential is a static function and the condition that the massive object moves uniformly, establish that inertia rules the dynamics of the situation. These conditions define a quaternionic field that does not change. The real part of the field is represented by the gravitation potential, and the uniform speed of the massive object represents the imaginary (vector) part of the field.

The change of the quaternionic field can be divided into five separate changes that partly can compensate each other.

The first order change of a field contains five terms. Mathematically, the statement that in first approximation nothing in the field ξ changes indicates that locally, the first-order partial differential $\nabla\xi$ will be equal to zero.

$$\zeta = \nabla\xi = \nabla_r\xi_r - \left\langle \vec{\nabla}, \vec{\xi} \right\rangle + \vec{\nabla}\xi_r + \nabla_r\vec{\xi} \pm \vec{\nabla}\times\vec{\xi} = 0 \qquad (1.5.1)$$

The terms that are still eligible for change must together be equal to zero. These terms are.

$$\nabla_r\vec{\xi} + \vec{\nabla}\xi_r = 0 \qquad (1.5.2)$$

In the following text plays $\vec{\xi}$ the role of the vector field and ξ_r plays the role of the scalar gravitational potential of the considered object. We approximate this potential by using formula

$$g(r) \approx \frac{Gm}{r} \qquad (1.5.3)$$

The new field $\xi = \left\{ \frac{Gm}{r}, \vec{v} \right\}$ considers a uniformly moving mass as a normal situation. It is a combination of the scalar potential $\frac{Gm}{r}$ and the uniform speed $\vec{v}$.

If this object accelerates, then the new field $\left\{\frac{Gm}{r}, \vec{v}\right\}$ tries to counteract the change of the field $\dot{\vec{v}}$ by compensating this with an equivalent change of the real part $\frac{Gm}{r}$ of the new field. According to the equation (1.5.2), this equivalent change is the gradient of the real part of the field.

$$\vec{a} = \dot{\vec{v}} = -\vec{\nabla}\left(\frac{Gm}{r}\right) = \frac{Gm\vec{r}}{|\vec{r}|^3} \qquad (1.5.4)$$

This generated vector field acts on masses that appear in its realm.

Thus, if two masses m_1 and m_2 exist in each other's neighborhood, then any disturbance of the situation will cause the gravitational force

$$\vec{F}(\vec{r}_1 - \vec{r}_2) = m_1\vec{a} = \frac{Gm_1m_2(\vec{r}_1 - \vec{r}_2)}{|\vec{r}_1 - \vec{r}_2|^3} \qquad (1.5.5)$$

The disturbance by the ongoing expansion of the field suffices to put the gravitational force into action. The description also holds when the field ξ describes a conglomerate of platforms and m represents the mass of the conglomerate.

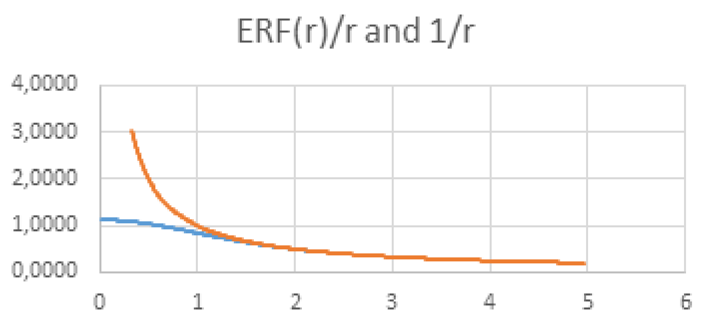
In compound modules such as ions and atoms, the field ξ of a component oscillates with the deformation rather than with the platform.

1.6 Pulse location density distribution

It is false to treat a pulse location density distribution as a set of point-like masses as is done in formulas (1.1.1) and(1.1.2). Instead, the gravitation potential follows from the convolution of the location density distribution and the Green's function. This calculation is still not correct, because the exact result depends on the fact that the deformation that is due to a pulse response quickly fades away and the result also depends on the density of the distribution. If these effects can be ignored, then the resulting gravitation potential of a Gaussian density distribution would be given by

$$g(r) \approx Gm\frac{ERF(r)}{r} \tag{1.6.1}$$

Far from the center of this distribution, the gravitation potential (blue line) looks again like the Green's function (red line) of the embedding field.



1.7 Elementary particles

For elementary particles, a private stochastic process generates the hop landing locations of the ongoing hopping path that recurrently forms the same hop landing location density distribution. The characteristic function of the stochastic process ensures that the same location density distribution is generated. This does not mean that the same hop landing location swarm is generated! The squared modulus of the wavefunction of the elementary particle equals the generated location density distribution.

2 Mass

2.1 Mass as a deformation strength characteristic

The fact that far from a massive object, the gravitation potential always takes the shape of the Green's function, gives the property mass an extra significance. The amplitude at a distance r can characterize the strength of the deformation that the massive object causes. Thus, if a spherical object is inserted into a continuum, then the deformation by this object is characterized by the amplitude of the gravitation potential $g(r) \approx \frac{Gm}{r}$ at a significant distance r. Thus. this amplitude determines the mass m of the object. It does not matter what the object is.

2.2 Blackhole

The object can be an encapsulated bubble that is generated by a non-continuous region that is encapsulated by a minimal surface. The surface is also a continuum. Inside the region, field excitations cannot exist. So, field excitations also cannot penetrate or leave the region. The phenomenon can be quite large and is known as a black hole.

In its simplest form, the region has the shape of a sphere. The black hole produces so much deformation and corresponding gravitation potential that one-dimensional shock fronts lose their energy before they reach the region. The encapsulating surface enables new physics because pulse responses behave differently in two dimensions. The direct surround of the region will attract many elementary particles that will cling with their geometric center to the encapsulating surface. This will introduce special conditions and corresponding phenomena. In the base model, elementary particles are represented by separate Hilbert spaces and the embedding field is represented by an eigenspace of an operator in a non-separable Hilbert space. The discrepant region may correspond to a subspace of the underlying vector space that does not own a private version of a number system to sequence the members of that subspace. Therefore, the black hole region does not show a specific symmetry other than what follows from the minimal encapsulating surface condition.

2.3 Mass versus volume

The pulses that generate the footprint of elementary particles temporarily deform the embedding field and permanently extends the volume of that field. The pulse causes an increment of the mass of the elementary particle. However. the corresponding deformation quickly fades away and must be recreated to ensure persistent mass.

Volume addition is persistent. Thus, here, a temporary increment of mass corresponds to a persistent increment of the volume of the embedding field. An increment of the mass of the black hole corresponds with an increment of the radius of the black hole. The corresponding increment of the volume of the black hole region is much larger than in the case of the elementary particle. Increasing the volume of the black hole causes an equivalent increase in the volume of the field that embeds the black hole. The mass that is added to the black hole does not quickly fade away.

References

The book "The Mathematics of Physical Reality" contains details and background for this paper. See: http://vixra.org/abs/1904.0388 or https://www.researchgate.net/project/The-Hilbert-Book-Model-Project/update/5d1a51a6cfe4a7968db0a7fd