Origin of Mass

By J.A.J. van Leunen

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Abstract

The origin of gravitation and mass is explained by the fact that spherical shock fronts locally and temporarily extend the volume of the carrier of this vibration. A surprising conclusion is that spherical shock fronts own an amount of mass.

Spherical shock fronts

The origin of mass is the fact that the homogeneous second order partial differential equation that describes the interaction between a point-like artifact and the continuum that embeds this artifact offers (among others) solutions that are spherical shock fronts. These shock fronts integrate into the Green's function of the embedding continuum. This fact means that during its travel the shock front extends and thus deforms the embedding continuum with the volume of this Green's function. In this case, having mass is synonym with the capability to deform its carrier. With other words, spherical shock fronts carry an amount of mass. However, spherical shock fronts fade away. The deformation works only temporary. The property mass only exists during the travel of the front.

Swarms of spherical shock fronts

A private stochastic process recurrently regenerates the locations in the hopping path in which an elementary particle hops around. Consequently, the process generates a coherent swarm of hop landing locations. A location density distribution describes the swarm. Each hop landing triggers a spherical shock front. The convolution of the Green's function with the location density distribution of the swarm describes the deformation of the carrier. This deformation is, in fact, the gravitation potential of the elementary particle. The characteristic function of the stochastic process ensures that the swarm is coherent and a gauge factor in this characteristic function implements a displacement generator. In this way, the swarm moves coherently as a single unit. The hopping path, the hop landing location swarm and the location density distribution describe the elementary particle. The characteristic function equals the Fourier transformation of the location density distribution. The location density distribution equals the squared modulus of the wave function of the particle.

Gravitation waves

Gravitation waves are quite probably spherical shock fronts or can be approximated by such shock fronts at sufficient distance from the trigger location. In that case it is better to call these phenomena gravitation shock fronts. The above deliberation means that such gravitation shock fronts have mass. These are macroscopic objects that possess mass without the inclusion of matter within the front. LIGO and Virgo have proven that gravitation waves exist. The super-tiny spherical shock shock fronts cannot be observed in separation but in huge swarms and huge clouds their effect becomes measurable. These are the miniature equivalents of gravitational waves.

For the gravitational wave, the center of mass does not move. So, there is no conflict with relativity laws.

Gravitation potential

The contribution of an elementary particle to the local gravitation potential is a smooth bump. This can be comprehended from a test location density distribution of the hopping location swarm. If this distribution equals a spatial normal distribution, then the convolution of the Green's function and a Gaussian distribution equals the deformation of the carrier. The result has the form ERF(r)/r. This is a smooth function that already at a small distance from the center location closely looks like the bare Green's function. It is important to note that this gravitation potential does not contain a singularity.

Inertia

Inertia cannot easily be described without formulas. If a massive object moves or changes, then a first order partial differential equation describes the dynamic change of the continuum.

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

$$\varphi_r = \nabla_r\psi_r - \langle \boldsymbol{\nabla}, \boldsymbol{\psi} \rangle$$

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

The Green's function $G(\boldsymbol{r})$ of the field can be considered as the result of the integration of a spherical shock front over a long enough period. Parameter $\boldsymbol{r}$ is the displacement from the location of the trigger.

$$G(\mathbf{r}) = 1/(4\pi|\mathbf{r}|)$$

However, $G(\boldsymbol{r})$ can also be considered as the effect on the field of a relative steady artifact. In that case, the Green's function can be interpreted as the scalar potential $\varphi(\boldsymbol{r})$ of the artifact. A real number valued charge characterizes the strength of the influence Q_1.

$$\varphi(\mathbf{r}) = Q_1\, G(\mathbf{r}) = Q_1/(4\pi|\mathbf{r}|)$$

Clamps are spherical shock fronts that are triggered by a point-like artifact. As such, every clamp represents a unit charge. Also, symmetry related charges represent point-like artifacts that characterize the strength of the corresponding potential.

If the point-like artifact moves rather than hops and this movement occurs with a uniform speed $\boldsymbol{v}$, then the scalar potential turns into a vector potential $\mathbf{A}(\mathbf{r})$.

$$\mathbf{A}(\mathbf{r}) = \varphi(\mathbf{r})\, \boldsymbol{v} = Q_1/(4\pi|\mathbf{r}|)\, \boldsymbol{v}$$

$$\boldsymbol{\nabla}(Q_1/(4\pi|\mathbf{r}|)) = -(Q_1)/(4\pi|\mathbf{r}|^3)\, \mathbf{r}$$

In the above formulas plays $\varphi(\boldsymbol{r})$ the role of ψ, and $\mathbf{A}(\mathbf{r})$ plays the role of $\boldsymbol{\psi}$. If the point-like artifact accelerates, then the change of the vector potential goes together with the existence of a new vector field **E**(**r**) that acts as a force raising field. This follows from the fact that the total change of the field stays zero. We suppose that the field is curl free.

$$\nabla_r \psi + \boldsymbol{\nabla} \psi_r = \mathbf{A}(\mathbf{r}) + \boldsymbol{\nabla}(Q_1/(4\pi|\mathbf{r}|)) = Q_1/(4\pi|\mathbf{r}|)\,\boldsymbol{\forall} - Q_1/(4\pi|\mathbf{r}|^3)\,\mathbf{r} = \mathbf{0}$$

$$\boldsymbol{\forall}(\mathbf{r}) = \mathbf{r}/|\mathbf{r}|^2$$

If the acceleration occurs in the radial direction, then this results in a force raising field **E**(**r**):

$$\mathbf{E}(\mathrm{r}) = \dot{\mathbf{A}}(\mathrm{r}) = Q_1/(4\pi|\mathbf{r}|)\,\boldsymbol{\forall} = Q_1/(4\pi|\mathbf{r}|^3)\,\mathbf{r}$$

With respect to this force raising field, another point-like charge with charge value Q_2 that is also embedded in the original field will sense a force **F**(**r**) that equals the product of the force raising field and the charge of the second embedded point-like object.

$$\mathbf{F}(\mathbf{r}_2\text{-}\mathbf{r}_1) = Q_2\,\mathbf{E}(\mathbf{r}_2\text{-}\mathbf{r}_1) = (Q_1 Q_2\,(\mathbf{r}_2\text{-}\mathbf{r}_1))/(4\pi|\mathbf{r}_2\text{-}\mathbf{r}_1|^3)$$

For the condition that the total change is kept zero, a force raising field $\mathbf{E}=\boldsymbol{\nabla}\psi_r$ is a component of the derivative $\nabla\psi$ of a base field ψ that can exert a force onto a charged object. The force raising field counteracts the change of the field when another component $\nabla_r\,\boldsymbol{\psi}$ of that field Φ is changed.

For example, inertia is the result of a force raising field that counteracts the acceleration of massive objects.

Other shock fronts

Double differentiation leads to the second order partial differential equation:

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

This equation splits into two first order partial differential equations $\Phi = \nabla\psi$ and $\rho = \nabla^*\varphi$.

Two homogeneous second order partial differential equations exist. Both equations have shock fronts as part of their solutions.

$$(\nabla_r\nabla_r + \langle\boldsymbol{\nabla}, \boldsymbol{\nabla}\rangle)\,\psi = 0$$

$$(\nabla_r\nabla_r - \langle\boldsymbol{\nabla}, \boldsymbol{\nabla}\rangle)\,\psi = 0$$

The second equation is the well-known wave equation.

It applies d'Alembert's operator $(\nabla_r\nabla_r - \langle\nabla, \nabla\rangle)$

Shock fronts only exist in odd numbers of participating dimensions

Aside from spherical shock fronts also one-dimensional shock fronts exist. This kind of shock fronts do not extend their carrier. This means that they do not deform that carrier. They only vibrate that carrier. Thus, these objects do not carry mass. Instead, they carry energy.

References

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