# INFORMATION AS THE SUBSTANCE OF GRAVITATIONAL FIELDS

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**Abstract**: Gravito-electromagnetism (GEM) describes the gravitational phenomena by introducing a gravitational field that can be viewed as a combination of two fields: a force field and an induction field. It is assumed that this composite field - that serves as a mediator for the gravitational interactions - is isomorphic with the electromagnetic field. In this essay we will show that the GEM-description of gravitation can perfectly be explained by the hypothesis that "information carried by informatons" is the substance of the gravitational field. Our starting point is that any material object manifests itself in space by emitting informatons: granular mass and energy less entities running away with the speed of light and carrying information about the position and the velocity of their emitter. We will show that the cloud of informatons emitted by a material object constitutes its gravitational field.

## 1. INTRODUCTION

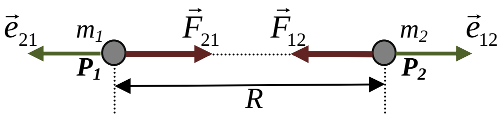


Fig 1

With respect to an inertial reference frame the gravitational force[1],[2] between any two particles at rest having masses $m_1$ and $m_2$ separated by a distance $R$ is described by *Newton's law of universal gravitation*, which - referring to Fig 1 - may be expressed as follows:

*The gravitational force* $\vec{F}_{12}$*, exerted on* $m_2$ *by* $m_1$ *and the gravitational force* $\vec{F}_{21}$*, exerted on* $m_1$ *by* $m_2$*, are given in direction and magnitude by the vector relations*:

$$\vec{F}_{12} = -\frac{1}{4\pi\eta_0}.\frac{m_1.m_2}{R^2}.\vec{e}_{12} \qquad \qquad \vec{F}_{21} = -\frac{1}{4\pi\eta_0}.\frac{m_1.m_2}{R^2}.\vec{e}_{21}$$

*Where* $\frac{1}{4\pi\eta_0} = G$ *is the "constant of universal gravitation"* *and* $\eta_0 = 1{,}19\times10^9 kg^2/(N.m^2)$.

Newton's law of universal gravitation describes the forces acting between particles as an "action-at-a-distance": the particles interacting even though they are separated in space. Because such a description leads to serious conceptual and methodological difficulties it turns out to be more convenient to introduce a vector field that plays an intermediate role in the forces between particles.

In Fig 1 mass $m_1$ sets up a *gravitational field* $\vec{E}_g$ in the surrounding space. In a point $P$ - whose position with respect to $P_1$ is determined by the displacement vector $\overrightarrow{P_1P} = \vec{r} = r.\vec{e}_r$ - $\vec{E}_g$ is defined in direction and magnitude by the vector relation:

$$\vec{E}_g = -\frac{1}{4\pi\eta_0}.\frac{m_1}{r^2}.\vec{e}_r = -\frac{1}{4\pi\eta_0}.\frac{m_1}{r^3}.\vec{r}$$

That gravitational field $\vec{E}_g$ exerts the *gravitational force* $\vec{F}_G$ on the mass $m$ in $P$:

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$$\vec{F}_G = m.\vec{E}_g$$

In a point of a gravitational field $\vec{E}_g$ is simply the force per unit of mass.

The role of a vector field as a mediator in the gravitational interactions between particles at rest can be successfully extended to interactions between moving particles by introducing a second field component. In the description of these interactions by gravito-electromagnetism (GEM)[3],[4],[5] the kinetic effects of gravity are taken into account by introducing $\vec{B}_g$, the *gravitational induction* or the cogravity. GEM describes the gravitational field by the vector pair ($\vec{E}_g, \vec{B}_g$).

Although the introduction of the field ($\vec{E}_g, \vec{B}_g$) makes it possible to describe the gravitational phenomena in an adequate way, it doesn't create clarity about their physical nature: the field is a purely mathematical construction. In this essay we will explain GEM by the hypothesis that *information is the substance* of the gravitational field. We start from the idea that any material object manifests itself in space by the emission of granular mass and energy less entities running away with the speed of light and carrying information about the position and the velocity of their emitter. Because they are carrying nothing but information we call these entities *informatons* and we will show that the cloud of informatons generated by a particle constitutes its gravitational field.

## 2. THE POSTULATE OF THE EMISSION OF INFORMATONS

The emission of informatons by a point mass *m* - a particle having a rest mass *m* - that is anchored in an inertial reference frame ***O***, is governed by the *postulate of the emission of informatons*:

**A**. *The emission* is governed by the following rules:

1. *The emission is uniform in all directions of space, and the informatons run away from their emitter along radial trajectories with the speed of light ($c = 3.10^8$* m/s).

2. $\dot{N} = \frac{dN}{dt}$ - *the rate at which a point-mass emits informatons*[1] *- is time independent and proportional to its rest mass m. So, there is a constant K so that:*

$$\dot{N} = K.m$$

3. *The constant K is equal to the ratio of the square of the speed of light (c) to the Planck constant (h):*

$$K = \frac{c^2}{h} = 1{,}36.10^{50}\, kg^{-1}.s^{-1}$$

**B**. We call the essential attribute of an informaton its *g-index*. The g-index of an informaton refers to information about the position of its emitter and its magnitude is the *elementary quantity of g-information*. It is represented by a vectorial quantity $\vec{s}_g$ :

1. $\vec{s}_g$ *points to the position of the emitter.*

2. $s_g$ *, the elementary quantity of g-information is:*

$$s_g = \frac{1}{K.\eta_0} = 6{,}18.10^{-60}\, m^3.s^{-1}$$

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1 $\dot{N}$ is the average emission rate. We neglect the stochastic nature of the emission. It is responsible for fluctuations in the gravitational field.

So, according to *the postulate of the emission of informatons*, a particle that is anchored in an inertial reference frame ***O*** is an emitter of informatons. The emission rate only depends on its mass *m* and is defined in section *A* of the postulate. The fundamental attribute of an informaton , its g-index, is defined in section *B*.

## 3. GRAVITATIONAL INTERACTION BETWEEN PARTICLES AT REST

### 3.1. The Gravitational Field of a Point Mass at Rest

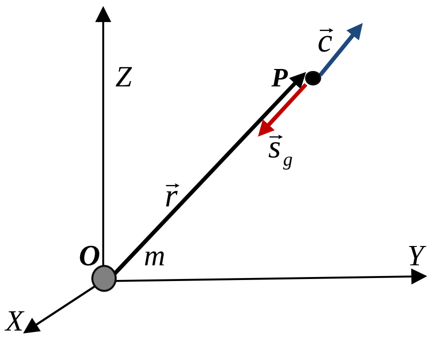


Fig 2

According to section A of the postulate of the emission of informatons, a point mass *m* anchored in the origin of an inertial reference frame ***O*** (fig 2) continuously emits informatons in all directions of space at a rate: $\dot{N} = K.m$

And according to section B, the g-index of the informatons passing with velocity $\vec{c} = c.\dfrac{\vec{r}}{r} = c.\vec{e}_r$ near the fixed point *P* - defined by the displacement vector $\vec{r} = \overrightarrow{OP}$ - is: $\vec{s}_g = -\dfrac{1}{K.\eta_0}.\dfrac{\vec{r}}{r} = -\dfrac{1}{K.\eta_0}.\vec{e}_r$ .

The rate at which the point mass emits *g-information* is the product of the rate at which it emits informatons with the elementary quantity of g-information:

$$\dot{N}.s_g = \frac{m}{\eta_0}$$

Of course, this is also the rate at which it sends g-information through any closed surface that surrounds *m*.

The emission of informatons fills the space around *m* with an expanding cloud of g-information. This cloud has the shape of a sphere whose surface moves away from the centre *O* with the speed of light.

- Within the cloud there is a *stationary state*. Because the inflow equals the outflow, each spatial region contains an unchanging number of informatons and thus a constant quantity of g-information. Moreover, the orientation of the g-indices of the informatons passing near a fixed point is always the same.

- The cloud can be described as a *continuum*. Each spatial region contains a very large number of informatons: it is as if the g-information is continuously spread over the volume of the region.

That expanding cloud of informatons surrounding the point mass *m* constitutes the *gravitational field of m* which implies that the substance of that cloud is g-information.

Without interruption “countless” informatons are flying through any - even very small - surface in the gravitational field: we can describe the motion of g-information through a surface as a *continuous flow* of g-information.

We know already that the intensity of the flow of g-information through a closed surface surrounding $O$ is expressed as: $\dot{N}.s_g = \frac{m}{\eta_0}$. If the closed surface is a sphere with radius $r$, the *intensity of the flow per unit area* is given by: $\frac{m}{4.\pi.r^2.\eta_0}$. This is the magnitude of the *density* of the flow of g-information in each point $P$ at a distance $r$ from $m$ (fig 2). This quantity is, together with the orientation of the g-indices of the informatons that are passing near $P$, characteristic for het gravitational field in that point.

Thus, in a point $P$, the gravitational field of the point mass $m$ is characterized by the vectorial quantity $\vec{E}_g$ :

$$\vec{E}_g = \frac{\dot{N}}{4.\pi.r^2}.\vec{s}_g = -\frac{m}{4.\pi.\eta_0.r^2}.\vec{e}_r = -\frac{m}{4.\pi.\eta_0.r^3}.\vec{r}$$

This quantity is the *gravitational field* or the *g-field* of $m$. In any point of the gravitational field of the point mass $m$, $\vec{E}_g$ points - such as the g-indices - to the position of the source of the field. And the magnitude of $\vec{E}_g$ is the *density of the g-information flow* in that point. We note that $\vec{E}_g$ is opposite to the sense of movement of the informatons.

Let us consider a surface-element $dS$ in $P$. Its orientation and magnitude are completely determined by the surface-vector $\overrightarrow{dS}$. By $-d\Phi_G$, we represent the rate at which g-information flows through $dS$ in the sense of the positive normal and we call the scalar quantity $d\Phi_G$ the *elementary g-flux through dS*: $d\Phi_G = \vec{E}_g.\overrightarrow{dS}$.
For an arbitrary closed surface $S$ that surrounds $m$, the outward flux (which we obtain by integrating the elementary contributions $d\Phi_g$ over $S$) must be equal to the rate at which the mass emits g-information. Thus:

$$\Phi_G = \oiint \vec{E}_g.\overrightarrow{dS} = -\frac{m}{\eta_0}$$

This relation expresses *the conservation of g-information*.

The above allows to conclude that the gravitational field is granular, that it continuously regenerates, that it expands with the speed of light, that it shows fluctuations, that there is conservation of g-information and that the gravitational phenomena propagate with the speed of light.

### 3.2. The Gravitational Force between Point Masses at Rest

We consider two point masses $m_1$ and $m_2$ anchored in the points $P_1$ and $P_2$ of an inertial reference frame $\boldsymbol{O}$ (fig 1). Each mass is "immersed" in a cloud of g-information. In each point, except its own anchorage, it contributes to the construction of that cloud. The gravitational field $\vec{E}_g$ in an arbitrary point $P$ of the space linked to $\boldsymbol{O}$ is completely defined by the vector sum of the gravitational fields caused by the distinct masses[6].

Let us consider the mass $m_2$. If $m_1$ was not there, then $m_2$ would be surrounded by its "own" gravitational field: a perfectly spherical cloud of informatons whose g-indices all point to the position of $m_2$. Because of the presence of $m_1$ this "*characteristic symmetry relative to $P_2$*" is disturbed. In the direct proximity of $m_2$, $\vec{E}_{g2}$ - the g-field in $P_2$ - is a measure for the extent of that disturbance. Indeed $\vec{E}_{g2}$ characterizes the intensity of the flow of g-information send to $P_2$ by $m_1$.

If it was free to move, $m_2$ could restore the characteristic symmetry of the g-information cloud in its direct proximity: it would suffice to accelerate with an amount $\vec{a} = \vec{E}_{g2}$. Accelerating this way has the effect that the extern gravitational field is cancelled in the origin of the reference frame anchored to $m_2$. If it accelerates this way, $m_2$ becomes "blind" for the g-information send to $P_2$ by $m_1$, it would only "see" its own spherical g-information cloud. These reflections lead to the following postulate.

*A point mass m anchored in a point P of a gravitational field is subjected to a tendency to move in the direction defined by* $\vec{E}_g$, *the g-field in that point. As soon as the anchorage is broken, the mass acquires a vectorial acceleration* $\vec{a}$ *that equals* $\vec{E}_g$.

This implies that a gravitational field $\vec{E}_g$ exercises an action on the mass *m* in *P*.

- That action is proportional to the extent to which the characteristic symmetry of the own gravitational field of *m* in the proximity of *P* is disturbed by the extern g-field, thus to the value of $\vec{E}_g$ in *P*.

- It depends also on the magnitude of *m*. Indeed, the g-information cloud generated by *m* is more compact if *m* is greater. That implies that the disturbing effect of the extern g-field $\vec{E}_g$ on the spherical symmetry around *m* is smaller when *m* is greater. Thus, to impose the acceleration $\vec{a} = \vec{E}_g$, the action of the gravitational field on *m* must be greater when *m* is greater.

We conclude: The action that tends to accelerate a point mass *m* in a gravitational field should be proportional to $\vec{E}_g$, the g-field to which the mass is exposed and to *m*, the magnitude of the mass. We represent that action by $\vec{F}_G$ and we call this vectorial quantity the *gravitational force* on *m*. We define it by the relation:

$$\vec{F}_G = m.\vec{E}_g$$

If the mass can freely move, it obtains an acceleration $\vec{a}$: $\vec{a} = \vec{E}_g = \dfrac{\vec{F}_G}{m}$

Generalizing: an action that tends to impose an acceleration $\vec{a}$ to a point mass *m* is a force defined by:

$$\vec{F} = m.\vec{a}$$

## 4. GRAVITATIONAL INTERACTION BETWEEN MOVING PARTICLES

### 4.1. The Gravitational Field of a moving Point Mass

In fig 3 we consider a point mass *m* moving with constant velocity $\vec{v}$ along the *Z*-axis of an inertial reference frame. Its instantaneous position at the moment *t* is $P_1$. The position of *P*, an arbitrary fixed point in space, is defined by the time dependant displacement vector $\vec{r} = \overrightarrow{P_1P}$. The informatons that at the moment *t* are passing near *P*, have been emitted when *m* was in $P_0$. Bridging the distance $P_0P = r_0$ took a time interval $\Delta t = \dfrac{r_0}{c}$. During $\Delta t$, the mass moved from $P_0$ to $P_1$: $P_0P_1 = v.\Delta t$

- $\vec{c}$, the velocity of the informatons, points in the direction of their movement, thus along the radius $P_0P$.

- $\vec{s}_g$ , their g-index, points to $P_1$, the position of $m$ at the moment $t$. This is an implication of rule B.1 of the postulate of the emission of informatons.

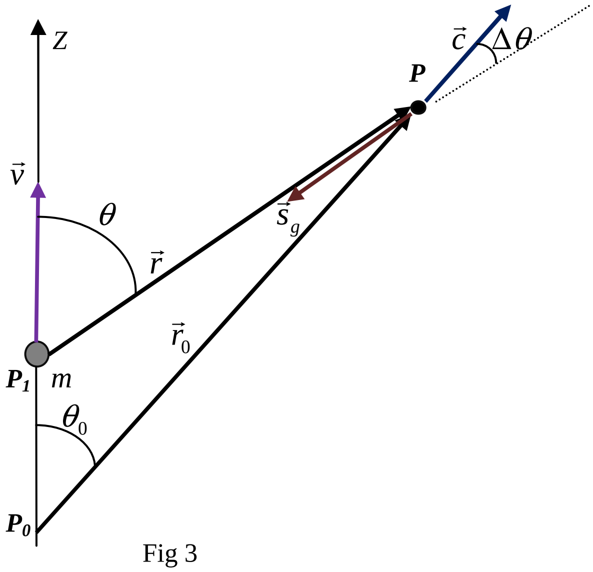


Fig 3

The lines carrying $\vec{s}_g$ and $\vec{c}$ form an angle $\Delta\theta$ that is determined by the law of sines in triangle $P_0P_1P$:

$$\sin(\Delta\theta) = \frac{v}{c}.\sin\theta = \beta.\sin\theta = \beta_\perp$$

where $\beta_\perp$ is the component perpendicular to $\vec{s}_g$ of the dimensionless velocity $\vec{\beta} = \frac{\vec{v}}{c}$. Because $\Delta\theta$ is characteristic for the speed of $m$ we call that deviation the "*characteristic deviation*" or the "*characteristic angle*"

All this implies that an informaton emitted by a moving point mass is not only a carrier of g-information referring to the position of that point mass, but also a carrier of information referring to its speed. We define this information as $s_\beta = s_g.\sin(\Delta\theta)$ . It is called the "*characteristic g-information*" or the "$\beta$*-information*" of an informaton. It is the magnitude of the vector $\vec{s}_\beta$ defined as:

$$\vec{s}_\beta = \frac{\vec{c} \times \vec{s}_g}{c}$$

$\vec{s}_\beta$ is called the "*gravitational characteristic vector*" or the "$\beta$*-index*" of an informaton. It is perpendicular to the plane formed by the g-index and the path of the informaton, and its orientation is defined by the "rule of the corkscrew. Taking into account the orientation of the different vectors, the β-index of an informaton emitted by a point mass moving with constant velocity $\vec{v}$ , can also be expressed as:

$$\vec{s}_\beta = \frac{\vec{v} \times \vec{s}_g}{c}$$

All this implies that an informaton emitted by a point mass $m$ moving with constant velocity $\vec{v}$ has two attributes:

its g-index $\vec{s}_g = -\frac{1}{K.\eta_0}.\frac{\vec{r}}{r} = -\frac{1}{K.\eta_0}.\vec{e}_r$ and its $\beta$-index $\vec{s}_\beta = \frac{\vec{v} \times \vec{s}_g}{c}$

respectively referring to the current position and to the velocity of $m$.

Macroscopically, the gravitational field[2] of $m$ is the manifestation of these attributes.

[2] The gravitational field of a moving mass is also called the "*gravito-electromagnetic field*" or GEM field

- The density of the flow of g-information in a point *P* refers to the magnitude and to the position of *m*. It is characterized by the "*g-field*" $\vec{E}_g$ defined as:

$$\vec{E}_g = N.\vec{s}_g$$

where $N$ is the density of the flow of informatons in *P* (the rate per unit of area at which the informatons cross an elementary surface perpendicular to the direction of movement).

$\vec{E}_g$ points to the current position of the point mass *m*. If the speed of *m* remains much smaller than the speed of light , we can assume that the displacement of the point mass during the time interval that the informatons need to move from the emitter to *P* can be neglected compared to the distance they travel during that period, what implies:

$$r \cong r_0 \qquad \text{and:} \qquad N = \frac{\dot{N}}{4\pi r^2} = \frac{K.m}{4\pi r^2}$$

So, in non-relativistic situations the g-field in *P* is given in direction and magnitude by:

$$\vec{E}_g = \frac{\dot{N}}{4.\pi.r^2}.\vec{s}_g = -\frac{m}{4.\pi.\eta_0.r^2}.\vec{e}_r = -\frac{m}{4.\pi.\eta_0.r^3}.\vec{r}$$

- The density of the cloud of β-information in *P* refers to the magnitude and to the velocity of *m*. It is characterized by the "*gravitational induction*" or the "*g-induction*"[3], a vectorial quantity represented by $\vec{B}_g$ and defined as:

$$\vec{B}_g = n.\vec{s}_\beta$$

where *n* is the density in *P* of the cloud of informatons (number of informatons per unit of volume).

With $n = \dfrac{N}{c}$:

$$\vec{B}_g = n.\frac{\vec{v}\times\vec{s}_g}{c} = \frac{\vec{v}}{c}\times(n.\vec{s}_g) = \frac{\vec{v}}{c^2}\times(N.\vec{s}_g) = \frac{\vec{v}\times\vec{E}_g}{c^2}$$

If $v << c$ then: $\vec{E}_g = -\dfrac{m}{4.\pi.\eta_0.r^3}.\vec{r}$ so $\vec{B}_g = \dfrac{m}{4.\pi.c^2.\eta_0.r^3}.(\vec{r}\times\vec{v})$

We define the constant $\nu_0$ = *9,34.10⁻²⁷ m.kg⁻¹* as: $\nu_0 = \dfrac{1}{c^2.\eta_0}$

And finally, we obtain:

$$\vec{B}_g = \frac{\nu_0.m}{4\pi r^3}.(\vec{r}\times\vec{v})$$

$\vec{B}_g$ in *P* is perpendicular to the plane formed by *P* and the path of the point mass; its orientation is defined by the rule of the corkscrew; and its magnitude is: $B_g = \dfrac{\nu_0.m}{4\pi r^2}.v.\sin\theta$

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[3] This quantity is also called the "cogravitational field", represented as $\vec{K}$ or the "gyrotation", represented as $\vec{\Omega}$ .

The previous discussion can be extended[6] to a point mass $m$ moving along a whether or not curved path. The gravitational field generated by $m$ in a point $P$ is completely defined by:

- the *g-field*: $\vec{E}_g = N.\vec{s}_g$, where $N$ is the density of the flow of informatons in $P$
- the *g-induction*: $\vec{B}_g = n.\vec{s}_\beta = n.\dfrac{\vec{c}\times\vec{s}_g}{c}$, where $n$ is the density of the cloud of informatons in $P$.

It can also be extended to a set of moving point masses and to a mass continuum. In reference [6] the gravitational field is studied in relativistic conditions, the laws of GEM are mathematically derived from the dynamics of the informatons, it is shown that an oscillating particle generates a gravitational wave and that it is the source of "*gravitons*": informatons that, beside g-information, carry a packet of energy.

### 4.2. The gravitational Force between Moving point Masses

We consider two point masses $m_1$ and $m_2$ moving with constant velocities $\vec{v}_1$ and $\vec{v}_2$ with respect to an inertial reference frame ***O***. They are the sources of a gravitational field that in each point of the space linked to ***O*** is defined by the vector pair ($\vec{E}_g$, $\vec{B}_g$). The g-induction $\vec{B}_g$ as well as the g-field $\vec{E}_g$ are completely defined by the vector sums of respectively the g-inductions and the g-fields caused by the distinct masses[6]. We assume that the speed of the two particles is negligible compared to the speed of light. Each mass is "immersed" in a cloud of informatons carrying both g- and β-information. In each point, except its own position, each mass contributes to the construction of that cloud.

Let us consider the mass $m_2$ that, at the moment $t$, passes in the point $P_2$. If $m_1$ was not there, $m_2$ would be surrounded by its "own" gravitational field ($\vec{E}_g^{'}, \vec{B}_g^{'}$). That field is a spherical cloud of informatons whose g-indices all point to the current position of $m_2$ and whose β-indices all "rotate" around the path of that point mass.

- The g-field $\vec{E}_g^{'}$ - the macroscopic manifestation of the g-information emitted by $m_2$ - points to $P_2$, the current position of $m_2$, and is symmetric with respect to that point,.

- The gravitational induction $\vec{B}_g^{'}$ - the macroscopic manifestation of the β-information emitted by $m_2$ - "rotates" around the path of that particle. We can associate to $\vec{B}_g^{'}$ a pseudo-g-field defined as $\vec{E}_g^{''} = \vec{v}_2 \times \vec{B}_g^{'}$ that points to and is symmetric with respect to the path of $m_2$.

We conclude that the characteristic symmetry of the "own" gravitational field ($\vec{E}_g^{'}, \vec{B}_g^{'}$) of $m_2$ can be characterized by [ $\vec{E}_g^{'} + (\vec{v}_2 \times \vec{B}_g^{'})$ ]. This vector field, the "*characteristic g-field* of $m_2$", is symmetric with respect to the path of its source.

Because of the presence of $m_1$, this characteristic symmetry is disturbed. $m_1$ is the source of the gravitational field ($\vec{E}_{g2}, \vec{B}_{g2}$) in $P_2$, and the expression [ $\vec{E}_{g2} + (\vec{v}_2 \times \vec{B}_{g2})$ ] is a measure for the extent of that disturbance in the direct proximity of $m_2$. The point mass $m_2$ can restore the symmetry of the characteristic g-field in its direct proximity: it would suffice to accelerate with an amount $\vec{a}' = \vec{E}_{g2} + (\vec{v}_2 \times \vec{B}_{g2})$ with respect to ***O'***, the inertial reference frame moving -with respect to ***O*** - with velocity $\vec{v}_2$. Accelerating this way has the effect that the extern gravitational field is cancelled in the origin of the reference frame anchored to $m_2$. If it accelerates this way, $m_2$ becomes "blind" for the information send to $P_2$ by $m_1$, it would only "see" its own g-information cloud. In the context of our assumption that the speeds of the moving particles can be neglected compared to the speed of light, $\vec{a}'$ - the acceleration of $m_2$ relative to ***O'*** - is equal to $\vec{a}$ - the acceleration of $m_2$ relative to ***O***. These reflections lead to the following postulate.

*A point mass m, moving with velocity $\vec{v}$ in a gravitational field ($\vec{E}_g, \vec{B}_g$), tends to become blind for the influence of that field on the symmetry of its characteristic g-field. If it is free, it will accelerate with an amount $\vec{a}$:*

$$\vec{a} = \vec{E}_g + (\vec{v} \times \vec{B}_g)$$

The action of the gravitational field ($\vec{E}_g, \vec{B}_g$) on a point mass that is moving with velocity $\vec{v}$ relative to the inertial reference frame ***O***, is called the *gravitational force* $\vec{F}_G$ on that mass. In extension of 3.2 it may be expressed as:

$$\vec{F}_G = m.\left[\vec{E}_g + (\vec{v} \times \vec{B}_g)\right]$$

## 5. CONCLUSIONS AND EPILOGUE

5.1. The fact that the “theory of informatons” permits to understand the nature of gravitation and to mathematically deduce the laws that govern the gravitational phenomena from the dynamics of the informatons, justifies the hypothesis that *information is the substance of the gravitational field* and it supports the idea that *informatons are the constituent elements of that substance*. The “theory of informatons” also implies that the informatons emitted by an oscillating point mass transport a packet of energy: they appear as “*gravitons*”.

5.2. The theory of informatons can also explain the phenomena and the laws of electromagnetism[7]. It is sufficient to add the following rule to the postulate of the emission of informatons:

Informatons emitted by an electrically charged point mass (a “point charge” *q*) at rest in an inertial reference frame, carry an attribute referring to the charge of the emitter, namely the e-index. e-indices are represented as $\vec{s}_e$ and defined by:

1. *The e-indices are radial relative to the position of the emitter. They are centrifugal when the emitter carries a positive charge (q = +Q) and centripetal when the charge of the emitter is negative (q = -Q).*

2. *$s_e$, the magnitude of an e-index depends on Q/m, the charge per unit of mass of the emitter. It is defined by:*

$$s_e = \frac{1}{K.\varepsilon_0}.\frac{Q}{m} = 8{,}32.10^{-40}.\frac{Q}{m} N.m^2.s.C^{-1}$$

*where* $\varepsilon_0 = 8{,}85.10^{-12}\, F/m$ *is the permittivity constant.*

Consequently (cfr § 4) , the informatons emitted by a moving point charge *q* have in the fixed point *P* - defined by the time dependant displacement vector $\vec{r}$ (cfr fig 3) - two additional attributes: their e-index $\vec{s}_e$ is in relation with the fact that *q* is a *charged* particle and their b-index $\vec{s}_b$ has to do with the fact that that particle is *moving*. In a point *P* - defined by the time dependent displacement vector $\vec{r}$ - these attributes are:

$$\vec{s}_e = \frac{q}{m}.\frac{1}{K.\varepsilon_0}.\vec{e}_r = \frac{q}{m}.\frac{1}{K.\varepsilon_0}.\frac{\vec{r}}{r} \qquad \text{and} \qquad \vec{s}_b = \frac{\vec{c} \times \vec{s}_e}{c} = \frac{\vec{v} \times \vec{s}_e}{c}$$

Macroscopically, these attributes manifest themselves as, respectively the *electric field strength* (the *e-field*) $\vec{E}$ and the *magnetic induction* (the *b-induction*) $\vec{B}$ in *P*. In reference [7] is shown that the theory of informatons makes it possible to mathematically deduce Maxwell’s laws from the dynamics of the informatons, to explain the electromagnetic interactions as the effect of the trend of an electrically charged object to become blind for flows of e-information generated by other charged objects and to identify photons as informatons carrying a quantum of energy, what allows us to understand the strange behaviour of light as described by QED.

## REFERENCES


1. **Resnick, David and Halliday, Robert.** *Fundamentals of Physics.* sl : John Wiley & Sons, 1970.

2. **Ohanian, Hans C.** *Physics.* sl : W.W. Norton & Company, Inc., 1985.

3. **Heaviside, Oliver.** *A Gravitational and Electromagnetic Analogy, Part I.* sl : The Electrician, 1893. Vol. 1893.

4. **Jefimenko, Oleg.** *Causality, Electromagnetic Induction, and Gravitation.* sl : Electret Scientific, 1992. Vol. 1992.

5. **Tajmar, M. and de Matos C.J.** *Advance of Mercury Perihelion explained by Cogravity.* 2003. arXiv: gr-qc/0304104.

6. **Acke, Antoine.** Gravitation explained by the Theory of Informatons. *http://vixra.org/pdf/1210.0135v1.pdf.* [Online] 2012.

7. **Acke, Antoine.** Electromagnetism explained by the Theory of Informatons. *http://vixra.org/pdf/1301.0114v1.pdf.* [Online] 2013.