INERTIA

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Leaning of the hypothesis of origin of forces of inertia as a result of a strain of **gravitational** ***waves of a field piercing a skew field, exterior forces, is given by interpretation of a principle of proportionality m_u and m_m, as corollaries of a dualism of properties of a gravitational wave. The association of magnitude m_u from strength of a gravitational field $g_{xi}^{(sum)}$ is detected and according to it sectional more bulk analysis of outcomes of experiments L.Etvesh , R.Dikke and V.Braginski. The concept of time is formulated. On the basis of a pushed hypothesis and classified data about planets the reasons of the "accelerated" extension of galaxies in a Galaxy of galaxies are resulted.***

The present article deals with the theory of gravitation, more specifically with the meaning of the principle of equivalence. In contemporary physics the essence of the inertial forces as distinct from "real" forces is explained as follows: "…the fundamental difference between inertial forces and ordinary forces of body interaction is that for the former it is impossible to specify the bodies acting on a material point" [9]. Rather it may be stated that the current physical conceptions are unable (so far) to specify the bodies whose action on a material point is defined by the inertial forces, because there is no more doubts about the reality of these forces [3]. Thus it seems to be evident that in the explanation of the origin of inertial forces it is necessary first of all to reveal those hidden (so far hypothetical) material objects (bodies) which are responsible for the appearance of the inertial forces. Inasmuch as inertial forces in inertial and non inertial coordinate systems accompanied by relative, convection and Coriolis acceleration are apparently of the same origin, i.e. are produced by the same material object, the latter must be presented by a wave train of the gravitational field, because, due to the exact proportionality between the gravitational and inertial masses, $m^{(i)}\mathbf{a} = \mathbf{F} = m^{(g)}\mathbf{g}$, [$m^{(g)}$, ($m^{(i)}$)-coefficient of proportionality between **F** and **g**, (**a**)] [8] this object should be of direct relevance to the inherent origin of the gravitation between real objects. In accordance to this, when waves of gravitation field of unique elastic structure, connected with bodies emanating it, penetrate a body having mass *m*, not only the attraction forces $\mathbf{f}_i^{(g)}$ between these bodies and mass *m* with the aid of the waves , but also elastic resistance of these waves with an inertial force $\mathbf{p}_i^{(i)}$ will occur for any movement of the body *m* under the action of f_i in any direction ($\mathbf{f}_i^{(g)} = -\mathbf{P}_i^{(i)}$). The mass *m* moves in the direction of $\mathbf{f}_i$ with an acceleration **a** resulting from the action of $\mathbf{f}_i$ rather than from the occurrence of $\mathbf{p}_i^{(i)}$, because $\mathbf{f}_i$ and $\mathbf{p}_i^{(i)}$ are applied to different points and thus cannot be balanced. Just this dualism of the gravitational wave train imparting the property of both attraction and inertness to a mass moving in the gravitational field represents the principle of equivalence and indistinguishability of inert and gravitation forces of the mass. So it is evident that in accordance with the principle of proportionality of $m^{(g)}$ and $m^{(i)}$ the inertial forces $\mathbf{P}^{(i)}$ should be real (ordinary) forces of interaction because forces of attraction $\mathbf{f}^{(g)}$ are real (subject to Newton's third law). It follows that the measure of inertia is not always inherent in mass, but manifests itself in accordance with the law of inertia $\mathbf{P} = m\mathbf{v}$, $\mathbf{f} = m\mathbf{a}$ only in the presence of the gravitation field (gravitation wave trains) in proportion to the gravitation field intensity **g**. There is no contradiction between this author's statement and the fundamental ideas of natural science about the origin of the inertial forces and their variation dependent on the intensity of the gravitational field. This interpretation of the origin of inertial forces follows immediately from conclusions of A.Einstein formulated in his works on general theory of relativity: "In a consistent theory of relativity it is impossible to define the inertia in relation to "space", but one may define inertia of masses in relation to each other. So if I remove some mass at a long enough distance from all other masses in the universe the inertia of this mass should tend to zero"[5]. However A. Einstein was unable to explain fully the origin of inertial forces, although in his expressions he was, as Ernst Mach, very close to it. "This suggests an idea that the inertia of material point is fully determined by the action of all other masses with the aid of some kind of interaction with them"[5]. Inertial forces are in proportion to the mass of material points and with other conditions being equal "impart" the same relative accelerations to them. The forces of gravitation possess the same property - in the same point of gravitational field these forces similarly to inertial forces are in proportion to the mass of material points and imparts them by the same acceleration in proportion to the **g** of the field. " Therefore the free motion of a body in relation to non inertial coordinate system is equivalent to its motion in relation to inertial coordinate system under the action of some additional (equivalent) gravitation field. This statement is called principle of equivalence."[9] "All physical processes in a true gravitation field and in an accelerated system in the absence of gravitation proceed by the same laws." [8] It was theoretically substantiated by A.Einstein that the forces of inertia arise in the body *m* in the course of its motion due to its interaction with all other bodies. It follows from the Einstein's general theory of relativity that when the clock in a point *P* with a gravitational potential Φ shows a local time σ, then in accordance with the relation $\sigma = \tau(1+\Phi/c^2)$ its reading is by a factor of $(1+\Phi/c^2)$ larger than τ, i.e. it is by a factor of $(1+\Phi/c^2)$ faster than similar clock located in the origin of coordinates [1]. The validity of Einstein's statement that the clock moves slower when it is located near ponderable masses [1], has been proved experimentally with the aid of atomic clock of high accuracy. In an altitude of 10 km from a surface of the Earth the atomic clocks freshened the way for $\approx 1 \cdot 10^{-10}$ second within one second [5]. However, equation $\sigma = \tau\ (\ 1 + \Phi\ /\ C^2$ for arbitrary coordinates ζ is inapplicable and should be exchanged, for example, on such: $\sigma = \tau\ [\ 1+(\ g_\tau - g_\sigma\ ) \cdot \chi\ ]$ sec, where τ - course of hours in an origin; σ - course of hours in an investigated point of space; χ - factor proportionality, $\chi \approx 1 \cdot 10^{-10} / [\tau \cdot (\ g_\tau - g_\sigma\ )\ ] \approx 3{,}250056 \cdot 10^{-9}\ sec^2 \cdot m^{-1}$. From this equation follows, what at $(\ g_\tau - g_\sigma\ ) \cdot \chi = -1, \sigma = 0$, certainly from the point of view of the spectator located in an origin ($g_\tau = 0$). Let's define tension g_σ at which one it will happen. – $g_\sigma \cdot \chi = -1$, $g_\sigma \approx 3{,}0 \cdot 10^8$м ·сек$^{-2}$, $[g_\sigma] \approx [C]$. If to accept weight of the Universe of $M \approx 2 \cdot 10^{53}$ kg ($\approx 10^{80}$atoms of Hydrogenium), then her gravitational radius $r_g = 2MG/C^2 = 2{,}966 \cdot 10^{26}$ m. [8] However at tension g_σ radius of the Universe will make $g_\sigma = MG / r^2_{g\sigma}$; $r_{g\sigma} = \sqrt{MG\ /\ g\sigma} \approx 2{,}109 \cdot 10^{17}$ m << r_g ; $V_\sigma = 3{,}92 \cdot 10^{52}$ m^3, $\rho_\sigma = 0{,}0051$ gr · cen^{-3}. It means, what for the external spectator (coordinate time) the Galaxy of galaxies begun to contract in a black hole at nearing to $r_{g\sigma}$, as though stiffens in the sizes, asymptotically coming nearer to $r_{g\sigma}$, but never it reaching (σ→0), though actually contraction is prolonged, up to a condition of a singularity (in center $\rho \le \rho_p = 5 \cdot 10^{93}$ gr · cen^{-3}). So the course of the clock depends on the intensity of the gravitation field, i.e. it increases with the height above the Earth surface. It follows from the equation for the period of oscillation of chronometer balance wheel $T = 2\pi\sqrt{J / c}$ that the period *T* is independent of the force of gravity but is proportional to the inertia moment of the balance *J*, i.e. to the value of the balance inertia change (inert mass). It thus appears to be proved tha namely gravitation waves, when they penetrate a moving body (i.e. balance wheel), give rise to inert forces applied, due to interaction, to this body. Moreover the magnitude of these forces as well as gravitational ones is also proportional to the gravitation field intensity. It is evident that the extension of absolutely all processes (clocks) in the universe is explained solely by inertness of all elements constituting this process, i.e., depends in the chosen reference system on the value of **g** in the given point of measurement x_i. This is perceived by us the extension (the objective - true forms of existence driving substance), as " … abstraction, we come to which one, watching change of things … " [1] Thus, is concluded, that the time always concerning and discretely, grows out interplays between material objects, outside of this interplay there is no and on value proportionally tension of a gravitational field g in each point of space. Let us use the obtained conclusion in the analysis of a such well-known phenomenon as the body free falling demonstrating clearly the forces of gravitation and inertia, $\mathbf{F}^{(g)}$ and $\mathbf{P}^{(i)}$, to show proofs of the proposed mechanism responsible for the appearance of inertial forces. Falling of a body with a mass *m* in a gravitation field of a mass *M* with acceleration **a** is accomplished due to the opposite oriented forces $\mathbf{F}^{(g)}$ and $\mathbf{P}^{(i)}$ applied to the body simultaneously and in equivalence in accordance with the equation of motion of the body *m* in a gravitation field $m^{(i)}\mathbf{a} = \mathbf{F} = m^{(g)}\mathbf{g}$, where **a** is the acceleration due to gravitation field intensity **g**. However, as it follows from the consideration above, both gravitational and inertial forces (of opposite direction) are resulting from the interaction of the same bodies - mass *m* and gravitation wave trains of mass $m^{(g)}$. Inasmuch as $\mathbf{F}^{(g)}$ and $\mathbf{P}^{(i)}$ are acting simultaneously, are of equal magnitude, are oriented in opposition, and are resulting from the interaction of the same masses *m* and $m^{(g)}$, they are forces of interaction obeying the Newton's third law. In contemporary natural science with its physical idea of mass as a logical category following immediately from the Galilean principle of proportionality and Newton's mechanics the fact that the bodies falling near the Earth surface have the same acceleration seems to be quite natural and easily understandable, if one takes into account that the gravitational force is proportional to the body mass and that the same mass characterizes the inertia of the body. However similar "explanation" at all does not explain a physical essence of process of preservation by bodies at their free fall of persistence of acceleration **a**, as the confirmation, that m of a body is not included in expression of acceleration of gravity ($a= G M_E/R^2$) contradicts a principle of proportionality of the Galilean $a=Gm^{(g)}M_E /m^{(i)}R^2;\ m^{(g)}>m^{(i)}$ .Here it is absolutely clear that the attraction of body *m* to the Earth (force $\mathbf{F}^{(g)}$) is determined mainly by the Earth gravitation field, because the field of all others objects of the universe of mass $M = \sum_i M_i$ [7] displays no property of directional polarization. At the same time the inertial force $-\mathbf{P}^{(i)}_{sum} = F^{(g)}$ at the earth surface should be dependent on all gravitation wave trains of any polarization state and direction of propagation. (ρ_{xi} kg · m^{-3}) This follows from the mere definition of the inertia mechanism, in accordance to which penetration of the body *m* by the waves of gravitation field of unique origin emanated by the bodies of the universe results in both attraction of *m* to these bodies with forces $\mathbf{F}_i^{(g)}$ and elastic resistance to any movement of *m* under the action of any $\mathbf{F}_i^{(i)}$ in the field of the wave trains with inertial forces $\mathbf{P}_i^{(i)}$. However, in any case in accordance with the third law of mechanics the value of $\mathbf{P}^{(i)}_{sum}$ is determined solely by the force of pressure on the field, i.e. in the present case by the force $\mathbf{F}^{(g)}$. So the motion of the body *m* in the gravitation field of *M* is connected to the inevitable deformation of the resultant gravitation field by the forces $\mathbf{F}^{(g)}$ and appearance of the inertial forces $\mathbf{P}^{(i)}$ acting on the body *m*. In this case the Newton's law of gravitation $\mathbf{F}_{12} = G\dfrac{m_1 m_2}{R^2}\dfrac{\mathbf{R}_{12}}{R}$ should also be written in the form of equation of the field elastic deformation by forces $\mathbf{F}^{(g)}$, i.e. $dF^{(g)}=\sigma^{(g)}dS$ (*H*) [9],where $\sigma^{(g)} =g_1g_2 /G$ Nm^{-2}, $g_1= m_1G/R^2$ N kg^{-1}, $g_2=m_2G/R^2$ N kg^{-1}, $S \approx R^2$. All other kinds of inertia arising in inertial and non inertial frames of reference during the motion of a body *m* having relative $\mathbf{a}_r$, transport $\mathbf{a}_t$, coriolis $\mathbf{a}_c$, accelerations under the action of a force **F** in the field of gravitation are appearing in a similar way, i.e. in all cases of the appearance of inertial forces the body *m*, under the action of applied force **F**, deforms the gravitational wave trains penetrating that body and transferring this deformation to the surrounding gravitation field connected to all bodies (including body *m*) with the velocity $\mathbf{V}_{gr}$ over the distance of the deformation decay to zero which is in proportion to the applied force **F**. It is evident that the value of $\mathbf{P}^{(i)}$ is not defined directly by the acceleration **a** of the body, because the deformation of the gravitation field is produced by the applied force **F**. This deformation propagates with the velocity $\mathbf{V}_{gr}$, so $\mathbf{P}^{(i)}$ appears to be resulting from the action of the deformed field on *m* and propagates in space (as well as the force **F**) with the same velocity $\mathbf{V}_{gr}$. Under the action of forces **F** and $\mathbf{P}^{(i)}$ forming in different bodies (applied at different points) the mass *m* begins to move with acceleration along the line connecting the points in accord to **F**. Thus the acceleration is **a** consequence of the action of forces **F** and $\mathbf{P}^{(i)}$ on the body *m* rather than a reason of their appearance (in particular, $\mathbf{P}^{(i)}$). In this connection it could be more logical to write the equation for the inertial forces $\mathbf{P}^{(i)}$ in terms of the deformation of all-round tension (compression) of the gravitation field similar to the

Hooke equation for the elastic deformation. In this case it is reasonable to combine the Galilean equation of proportionality $m^{(i)}\mathbf{a} = \mathbf{F} = m^{(g)}\mathbf{g}$ with the measure of deformation – relative deformation $\Delta\lambda/\lambda$ from the Hooke's law $\sigma=k\Delta x/x$ [9]. In accordance with the principle of proportionality all bodies fall with the same acceleration **a** under the action of gravitation field intensity $\mathbf{g}_{xi}$. It is that alone case when the body m moves only under operating of gravity $\mathbf{F}^{(g)}$ and of inertia $\mathbf{P}^{(i)}$ and these forces are peer among themselves. / $\mathbf{F}^{(g)}= - \mathbf{P}^{(i)}$ / In all remaining cases, when the external force $\mathbf{F}^{ext}$ is not gravitational and $\mathbf{F}^{ext} \neq \mathbf{F}^{(g)}$, the equation of proportionality $|P^{(i)}| = m^{(g)}g_{xi}$ is not abided, but can be corrected by the registration of strain $\Delta\lambda / \Delta\lambda^{(g)}$ of a gravity wave of a field, in each particular case, i. e. $\mathbf{P}^{(i)} = - m^{(g)}\mathbf{g}_{xi}\,\Delta\lambda / \Delta\lambda^{(g)}$ (N), where $\Delta\lambda^{(g)}$ (m) is the absolute deformation of the gravitational wave of a field called by an operation is exclusively of gravitational forces $\mathbf{F}^{(g)}$ or exterior forces, peer to them $\mathbf{F}^{ext}$, ($\mathbf{F}^{ext} = \mathbf{F}^{(g)}$), operating in the same gravitational field of intensity $\mathbf{g}_{xi}$, $\Delta\lambda$ (m) is the absolute deformation of the gravitation wave when the field $\mathbf{g}_{xi}$ is deformed by the applied force $\mathbf{F}^{(ext)}$. It is absolutely clear that $\Delta\lambda^{(g)}$ remains constant ($\Delta\lambda^{(g)}$ =const) in any frame of reference and any gravitation field intensity **g**. However, due to the extreme complexity of determination of $\Delta\lambda$, λ for each specific case (detecting the wave λ before and after deformation) , for practical purposes it is much more convenient to have equations including such an indirect characteristic of a moving body as the acceleration **a**, which is more convenient and may be measured accurately. For this reason the equation $\mathbf{P}^{(i)} = - m^{(i)}\mathbf{a}$ is much more convenient in practical use in comparison to the equation of the field deformation, although the former does not reflect the essence of the involved processes. Thus, pursuant to introduced here with definitions of the gear of originating of force of inertias Pu, in process of deleting from a beginning of coordinate system, selected by us, X0, Y0, Z0, describing a gravitational field intensity gxi (Нкг -1) decreases, and together with it (agrees definitions) should to decrease and inert weight mu, determining value of arising acceleration **a** in depending on applied on a body weight m of force F. According to the Galilean principle of proportionality $m^{(i)}\mathbf{a} = \mathbf{F} = m^{(g)}\mathbf{g}$, the stability of planet orbital motion around the Sun is determined by the exact equality between the gravitation forces and force of inertias ($\mathbf{F}^{(g)} = -\mathbf{P}^{(i)}$). Let us analyze, on the basis of available data, the changes of $m^{(i)}$ and $\mathbf{a}^{(p)}$ of planets with the distance to the Sun (coordinate origin x_0, y_0, z_0). The available and obtained results are given in Table. The analysis of the data of Table enables to arrive at the following conclusions. In the solar system the ratio $m^{(i)}/m^{(g)}$ decreases with the increase of the distance from the Sun, which means that the inertial mass $m^{(i)}$ (inertia $\mathbf{P}^{(i)}$) decreases with decreasing of intensity of a gravitational field g_{xi}. It becomes evident that in accordance with the principle of proportionality the decrease of $m^{(i)}$ with ascending of spacing interval from the Sun leads to an increase of the centripetal acceleration in such a way that decreasing with spacing interval from an origin X_0, Y_0, Z_0 of value $\mathbf{F}^{(g)}|$ and $|\mathbf{P}^{(i)}$ always remain equal to each other (principle of equivalence). Furthermore it follows from the Table that the third Kepler's law $4\pi^2a^3/T^2 = fM$ [6],[9], where a is the major semi axis of the elliptical orbit, equal to the mean radius of the orbit [6], cannot be valid in principle, because on substitution of $T = 2\pi/\omega$ one obtains $a^3\omega^2 = fM$, $\omega^2 a = fM/a^2$, $\mathbf{a}^{(n)} = \mathbf{g}$, i.e. an equation which is in agreement with the Galilean principle of proportionality $m^{(i)}\mathbf{a}^{(n)} = \mathbf{F} = m^{(g)}\mathbf{g}$ for the only case when $m^{(i)} = m^{(g)}$. Just this condition is not satisfied, because it is seen from Table that $m^{(i)}/m^{(g)} < 1$. According to the Galilean principle $m^{(i)}/m^{(g)} = g_{xi}/a^{(n)}$ the inertial force the planets of solar system (rotating masses) may be presented, after simple transformation, as $\mathbf{P}^{(i)}= - m^{(g)}\varphi\,\mathbf{a}^{(n)}/v^2$. This form of equation for $\mathbf{P}^{(i)}$ conforms to the author's opinion that inertia (inertness) depends on the value of gravitation potential φ (**g**) in the given point x_i, y_i, z_i and decays to zero with moving $m^{(g)}$ away to infinity from the gravitating mass $M^{(g)}$ located at the coordinate origin x_0, y_0, z_0.Furthermore, taking into account the data of column 10 of Table is constrained to conclude that the mass m located in the same gravitational field with intensity g_{xi} manifests its inertial and gravitational properties in a different way, because for all planets $m^{(i)}/m^{(g)} < 1$ and this ratio becomes smaller and smaller as the distance to the coordinate origin (Sun) increases. For explanation this appearance should search in the following. Field intensity

$\mathbf{g}_v$ inside the moving body will be greater than in the surrounding space ($\mathbf{g}_v = \mathbf{g}_{xi} + \mathbf{g}_m$) and will increase ($\mathbf{g}_m = f(\mathbf{v})$ in proportion to the increase of the body velocity **v**. Let's transform a Galilean principle of proportionality $m^{(i)}\mathbf{a}=\mathbf{F}=m^{(g)}\mathbf{g}$ in $m^{(i)}|\mathbf{g}_v| = \mathbf{F} = m^{(g)}\mathbf{g}_{xi}$ and as $|\mathbf{g}_v| > \mathbf{g}_{xi}$, becomes apparent, what $m^{(i)} < m^{(g)}$ and ($|\mathbf{g}_v| = |\mathbf{a}^{(n)}|$). The data analysis of the table confirms (graphs 7,8,9,10) decreasing $m^{(i)}$ as against $m^{(g)}$ =const ($m^{(i)}/ m^{(g)} = \varphi / v^2 < 1$) at deleting weight m from an origin X_0, Y_0, Z_0 (Sun) and correctness by the reduced author of articulatings. In accordance to the above given definition of the mechanism of appearance of inertial forces as a reaction of the deformed field it may be concluded that it is this reason which is responsible for the progressive decrease of the ratio $m^{(i)}/m^{(g)}<1$ as the distance to the coordinate origin increases. As approaching an origin of coordinates, (M_E in an origin of coordinates) magnitude of an inertial mass $m^{(i)} = m^{(g)} \varphi / V^2$ gradually will increase coming nearer to magnitude of a heavy mass ($m^{(i)} \rightarrow m^{(g)}$) in (·) X_0, Y_0, Z_0. It should be noted that the suggested by the author dependence of $m^{(i)}$ on the space distribution of m in relation to the coordinate origin is confirmed by the data given in column 10 of the Table. Thereby, resuming the aforementioned, the essence of the inertia and its manifestations may be reduced to the following. The gravitation field forming the space of the universe and produced by its material bodies is presented by an unique elastic structure linked with all sources of its radiation into an unified gravitationally closed integer ($M \geq M_{cr}$), excluding energy exchange with material objects outside this space. Any material body penetrated by gravitation wave trains of this space is attracted by them in all directions quasi pinning it in the volume occupied by the body. So to move the material body m it is necessary to apply a force **F** overcoming these gravitation forces. Here in accordance to the third law of mechanics the inertial force $-\mathbf{P}^{(i)}$ arises being equal in strength to **F** and in opposition to it. Namely this dualism of the gravitation wave train which provides the mass moving in the gravitational field with the ability to be attracted and the property of inertia constitutes the principle of equivalence and indistinguishability of inert and gravitation forces of this mass. Inertness of the mass $m^{(i)}$ decreases in the direction from the centre of the universe (Galaxy of galaxies) in a nonuniform fashion (now decreasing, now even increasing) in dependence on the values of ρ_{xi} (kg·m^{-3}), $\mathbf{g}^{(sum)}_{xi}$ in the given point of the space. Inside a galaxy the inertia, as a rule, is larger than in the intergalactic space. However outside the universe the inertia reduces to zero. With magnification of a velocity **V**i of uniform transition of a skew field m in space, the inertness of this skew field (very small) begins noticeably to increase only at an approximation of a velocity **V**i to $\mathbf{V}_{gr}$. For $\mathbf{v}_i \approx \mathbf{V}_{gr}$ the density of the field (wave trains) ρ_{xi} inside the moving body increases infinitely, in consequence the deformation of the wave trains ($\rho_v \rightarrow \infty$) determines the trends $\mathbf{P}^{(i)} \rightarrow \infty$, (from the point of view of the off-site observer). The field is an indispensable condition and unique medium for the accomplishment of any interactions, providing finally the point of application (rest) for forces of any origin and character. Out of the field the interaction of material bodies and their existence itself are impossible [8]. For the same reason there are no jet propulsions described by the equation $M\frac{dv}{dt} = -v\frac{dM}{dt}$, because of the disappearance of the inertia of the ejecting mass dM and the mass of the rocket M, ($-v\frac{dM}{dt}$ =0), i.e. because of the absence of the gravitation field support for the dM (e.g. gas jet) and M. However, to be consistent, one may conclude that the stream dM itself should not be formed in the absence of the field for a variety of reasons, such as, e.g., absence of the pressure in the jet engine, because the internal energy of chaotic motion of all micro particles (molecules, atoms, ions, etc.) generated during combustion is zero in the absence of inertia ($m^{(i)}\mathbf{v}^{(i)} = 0$). The resistibility of the wave trains (inertia) to any displacement (deformation) is determined only on their unification into a field – a unique "elastic" structure connected to and created by the material bodies. The transfer of the "impulse" (without the field $m^{(i)}\mathbf{V}_{gr} = 0$) by the wave of the surface onto which it is falling is also determined as a result of the elastic association of the wave trains into an unique gravitation field (the wave rests upon the field) and continuous connection of this field to all material bodies created it. As for the motion of the body *m* outside the field "by inertia" it is impossible from the point of view of any observer because of the following. The impulse of "motion" of the mass *m* is zero ($m^{(i)}$=0 and $m^{(i)}\mathbf{v} = 0$), interaction with *m* is unfeasible (there is no support of the external forces $\mathbf{F}^{(i)}$, the third law of mechanics is impracticable), the motion is irrelative, hence absolutely undefinable. It follows, that the condition of motion and rest of a body m are determined by a field, ambient him, - outside of a field these condition are dispossessed of sense. (the time - does not exist, space - does not exist and therefore the speed also - does not exist). Then in STR factors $\sqrt{1-v^2/c^2}$ is necessary for exchanging on $\sqrt{1-v^2/v_{gr}{}^2}$. (Always $\mathbf{V}_{gr} = \mathbf{C}$ at $\infty > \mathbf{g}_{cyмxi} \geq 0$) So the inertial as well as gravitational forces are resulting in material bodies by the action of gravitation wave trains moving in space (their deformation) when they penetrate the bodies and, consequently, are ordinary forces of interaction similar to the forces of elasticity, friction, etc. The proposed by the author interpretation of the inertial forces enables to explain the physical meaning of many physical processes and phenomena. Let us dwell on some of them.

(a) It is known that the principle of equivalence of the gravitation and inertia generalizing the Galilean principle of proportionality is the basis of the Einstein's theory of gravitation (GTR). "Principally in no way it follows that the mass *M* producing the gravitation field also determines the inertia of the same body. However the experiment shows that the inertial and gravitational masses are proportional to each other (and are numerically equal for conventional units of measurement)" [8]. " So it is possible to think, with an appropriate choice of the value of the gravitation constant, that for any body its gravitational and inertial masses are equal and connected with the gravitation force **P** of this body by a relation *m* =**P**/**g**, where **g** is the free fall acceleration " [9]. It is seen that the purely mathematical possibility equalities ($G_{new}=G\cdot v^2/\varphi$) between the inertial $m^{(i)}$ and gravitational $m^{(g)}$ mass was formulated rather long ago as a possible interpretation of the Galilean principle of proportionality."If $m^{(i)}$ and $m^{(g)}$ are proportional and the coefficient of proportionality is equal for all bodies, then the measurement units may be chosen in such a way, that this coefficient will equal to unity, $m^{(i)}= m^{(g)}$, the masses are cancelled in the equation $m^{(i)}$a= F= $m^{(g)}$g, and **a** is independent of mass and proportional to the intensity **g** of the gravitation field,..." [8]. However this, strictly speaking, local interpretation ($m^{(i)}= m^{(g)}$) was transformed, by efforts of a number of authors, into a statement for everyday use which was extended with no proper grounds far beyond the limits of its applicability (X_0, Y_0, Z_0). "From the principle of equivalence it follows the equality of $m^{(i)}$ and $m^{(g)}$, because otherwise even mechanical movements in an accelerated reference frame and in a gravitational field would proceed in a different way" [2]. Generally speaking the situation is quite the contrary, because if $m^{(i)} = m^{(g)}$ in some point x_i, y_i, z_i except for the coordinate origin it will be this point where the principle of equivalence (forces) is violated inasmuch as $m^{(i)}\mathbf{a}= \mathbf{F}= m^{(g)}\mathbf{g}$ for a> g, [$P^{(i)}$]> $F^{(g)}$ (columns 7, 8 of Table). I think that this too voluntarily handling with the Galilean principle of proportionality resulted in a not quite correct interpretation of the experiments on verification of the equivalence principle performed in due time by L. Etvesh, R. Dikke and V. Braginski: "...the now established ultrahigh accuracy of the equality $m^{(i)}= m^{(g)}$ (according to [44] $(m^{(i)}- m^{(g)})/m^{(i)}< 10^{-12}$ enable to make also an indirect conclusion that the equivalence principle is also valid in the theory of electromagnetic and strong (and partly weak) interactions..." [2].The GTR is based on a fundamental experimental fact of the equality of the ratio of the inertial and gravitational masses for any bodies independent of their physical, chemical and other properties, i.e. $m_{Al}/M_{Al} = m_{Pt}/M_{Pt}$. Therefore this ratio which determines the space position of the torsional balance is, strictly speaking, independent of the absolute mass values, m_{Al}, m_{Pt}, and is valid for any masses and varying maintain strict equality in any point of space ($m^{(i)}/m^{(g)} = g_{xi}/a^{(n)}$). So the statement that the performed experiment (Δ < (-

0.3±0.9)·10^{-12} confirms the relation ($m^{(i)}$ - $m^{(g)}$)/$m^{(i)}$ < 10^{-12} is, softly speaking, incorrect. In accordance with the formulated position of the author on the origin of the inertial forces and $m^{(i)}$, meaning of the equivalence principle, and the given analysis of the experimental data it is only possible to claim that the relation $m_{Al}/M_{Al} = m_{Pt}/M_{Pt}$ is always valid.(are equivalent) So the value $\Delta = (m_{Al}/M_{Al} - m_{Pt}/M_{Pt}) /1/2\cdot(m_{Al}/M_{Al} + m_{Pt}/M_{Pt}) = 0$ and the obtained in the experiment successively decreasing numbers - $3\cdot10^{-9}$, $3\cdot10^{-11}$, $(-0.3\pm0.9)\cdot10^{-12}$ represent not the real values of the ratios of physical values included in Δ, but simulative effects of neglected and unclear origin. However, it follows from the Table (column 10) that the value of inertial mass $m^{(i)}$ varies in different points of space x_i, y_i, z_i decreases with the distance from the coordinate origin X_0,Y_0,Z_0, but, in accordance with the principle of (equivalence), it is independent on the origin and physical properties of the body, i.e. the inequality $\left[m^{(i)}_{Al}/M_{Al} = m^{(i)}_{Pt}/M_{Pt}\right]_{(\cdot)X_1} \neq \left[m^{(i)}_{Al}/M_{Al} = m^{(i)}_{Pt}/M_{Pt}\right]_{(\cdot)X_2}$ holds, which certainly has no effect on the values of Δ, Δφ in the proposed experiments and on the validity of the equivalence principle.

(b) Uniform motion.“The Newton’s first law insists that the state of rest or uniform rectilinear motion demands no external influences for their maintenance“ [3]. In accordance with the definitions of the origin of inertial forces considered above this statement may be absolutely true only in the case when any radiation (waves) are absent. In the real condition of existing gravitation field the body m moving with a velocity $\mathbf{V} \ll \mathbf{V}_{gr}$ will be continuously penetrated (attracted) in all directions by gravitation field wave trains, propagating in space with the velocity $\mathbf{V}_{gr}$ and continuously replacing each other. Bulk density of gravity waves ρ_v, ($\mathbf{g}_v$) inside the moving body m will be greater than in the surrounding space ($\rho_v = \rho_{xi} + \rho_m$) and will increase ($\rho_m = f$(v) in proportion to the increase of the body velocity **V**. In this case the gravitation wave trains $m^{(g)}$ attract the body, because the gravitation force $\mathbf{F}^{(g)}$ (deformation of the wave train $\Delta\lambda^{(g)}$) also propagates with the velocity **V**gr, while inertial forces $\mathbf{P}^{(i)}$ do not appear (are negligibly small), because at $\mathbf{V} \ll \mathbf{V}_{gr}$ the wave trains passing the gravitation (impulse) to the body m have time to leave it practically undeformed (the velocity of the field deformation in the direction of motion of m is **V** in the absence of $\mathbf{F}^{(ext)}$), renewing during the motion by newly irradiated trains. In accordance with the above given definitions for inertial forces $\mathbf{P}^{(i)}$ the forces $\mathbf{P}^{(i)}$ arising during retardation (acceleration) of the body m by an external force $\mathbf{F}^{(ext)}$ will be in proportion to the value of ρ_v at the given velocity, whereas the increase of the gravitation $\mathbf{F}^{(g)}$ due to the motion of the body m with a velocity **V** will occur only due to the change of the value $\mathbf{g}_{xi}$ Earth, i.e. from $\mathbf{g}_v = \mathbf{g}_{xi} + \mathbf{g}_m$. When the velocity of the body m approaches the $\mathbf{V}_{gr}$ ($\mathbf{V} \approx \mathbf{V}_{gr}$) the density of the field (wave trains) inside the body increases with no limit $\rho_{(v)} = \rho_{xi}/\sqrt{1 - v^2/v_{gr}^2}$ (kg m^{-3}), the wave trains passing the gravitation to the body ($\Sigma \mathbf{f}^{g}$) now have no time to leave it without deformation in the direction of **V** (inertia), thus voltage of a strain of a field σ (N·m^{-2}) skew field m at his driving with a velocity $\mathbf{V} \rightarrow \mathbf{V}_{gr}$ will increase unrestrictedly $\sigma = \rho_{xi} v^2/\sqrt{1 - v^2/v_{gr}^2}$ (N·m^{-2}) and accordingly inertia of a skew field m also unrestrictedly will increase $\mathbf{P}_u \rightarrow \infty$.

(c) According to contemporary ideas of the universe in cosmology, the Galaxy of galaxies was resulted from a large explosion of enormously compressed matter. The fact of the initial creative explosion in the evolution of the universe is proved by the present observation of the processes of its expansion – the galaxies comprising the universe scatter from the centre of supposed explosion. The character of the expansion remains unexplained, because its velocity increases with the distance to the centre in accordance with the cosmical constant H = 50 (km/s)/Mps. Attempts to explain the red shift in the galaxy spectra confirming the expansion apart from the Doppler effect were unsuccessful. However, the explanation becomes possible on the basis of interpretation of inertia given above. Inasmuch as the inertia of the matter is proportional to $g^{(sum)}_{xi}$, ρ_{xi} ($kg\cdot m^{-3}$), it will decrease as the distance to the centre of the iniverse increases, tending to zero at the universe boundary. According to the law of conservation of momentum (action integral of the system) $\mathbf{P} = \sum_{k-1}^{N} m_k \mathbf{v}_k = const$ [9] the decrease of the inert mass m_k will result in a proportional increase of the velocity $\mathbf{v}_k$ in order to keep the product $m_k v_k$ constant. Namely the decrease of the galaxy inert masses from the Galaxy of galaxies centre results, in accordance with the conservation law, in linear variation of H = (km/s)/Mps, in the increase of the velocity of objects comprising the Galaxy of galaxies. This explanation is confirmed by a specific data presented in Table showing a similarity in the decrease of $m^{(i)}$ as distinct from $m^{(g)}$ = const (columns 2, 9, 10) and simultaneous increase of $a^{(p)}$ as compared to g_{xi} (columns 7, 8), in accordance with the principle of proportionality $m^{(i)}\mathbf{a} = \mathbf{F} = m^{(g)}\mathbf{g}$ when the mass m moves away from the coordinate origin x_0, y_0, z_0 (the sun).

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TGU № 57- 06-03 -35 от 2.06.92г.)

Is published: 1. " Consciousness and physical reality " , №5, Moscow, 2002 y.

2. " APPLIED PHYSICS" №1, Moscow, 2003 y.

3. Proceeding of the IX International Scientific conference
August 7 – 11, 2006, Saint-Petersburg, Russia

Characteristics of planets

Planet name	Planet mass	Mean distance from the Sun	Sidereal period in tropical years (31469498 sec.)	Force of gravitation	Angular velocity	Centripetal acceleration	Gravitation field intensity	Inert planet mass	$m^{(i)}/m^{(g)}$, $g/a^{(p)}$
	$m^{(p)}$, kg	R, m		$F^{(g)} = G\frac{M_S m^{(p)}}{R^2}$ $F^{(g)} = F^{(i)}, N$	$\omega = 2\pi/T$ rad/sec	$a^{(p)} = \omega^2 R$, m/sek^2	$g = M_S G/R^2$ N/kg	$m^{(i)} = F^{(g)}/a^{(p)}$ kg	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Mercury	$3,289\cdot10^{23}$	$0,5791\cdot10^{11}$	0,240844	$1,3017442\cdot10^{22}$	$8,2893202\cdot10^{-7}$	$3,9791599\cdot10^{-2}$	$3,9578722\cdot10^{-2}$	$3,2714046\cdot10^{23}$	0,994650228
Venus	$4,87968\cdot10^{24}$	$1,0821\cdot10^{11}$	0,615184	$5,5312774\cdot10^{22}$	$3,245267\cdot10^{-7}$	$1,1396415\cdot10^{-2}$	$1,1335328\cdot10^{-2}$	$4,8535241\cdot10^{24}$	0,994639832
Earth	$5,98\cdot10^{24}$	$1,496\cdot10^{11}$	1	$3,5465565\cdot10^{22}$	$1,9964334\cdot10^{-7}$	$5,962676\cdot10^{-3}$	$5,930696\cdot10^{-3}$	$5,9479277\cdot10^{24}$	0,994636739
Mars	$6,3986\cdot10^{23}$	$2,2794\cdot10^{11}$	1,88	$1,6346048\cdot10^{21}$	$1,0619348\cdot10^{-7}$	$2,570491\cdot10^{-3}$	$2,554628\cdot10^{-3}$	$6,3591126\cdot10^{23}$	0,993828743
Jupiter	$1,9006832\cdot10^{27}$	$7,783\cdot10^{11}$	11,86	$4,1647081\cdot10^{23}$	$1,6832907\cdot10^{-8}$	$2,20528\cdot10^{-4}$	$2,1911637\cdot10^{-4}$	$1,8885167\cdot10^{27}$	0,99359888
Saturn	$5,691166\cdot10^{26}$	$1,4293\cdot10^{12}$	29,46	$3,6976292\cdot10^{22}$	$6,7765879\cdot10^{-9}$	$6,5636\cdot10^{-5}$	$6,4971\cdot10^{-5}$	$5,6335383\cdot10^{26}$	0,989874184
Uranium	$8,72482\cdot10^{25}$	$2,875\cdot10^{12}$	84,0219	$1,4010315\cdot10^{21}$	$2,3760267\cdot10^{-9}$	$1,623\cdot10^{-5}$	$1,6058\cdot10^{-5}$	$8,6323567\cdot10^{25}$	0,989402268
Neptunium	$1,03155\cdot10^{26}$	$4,5044\cdot10^{12}$	164,772	$6,7481586\cdot10^{20}$	$1,2116031\cdot10^{-9}$	$6,6123793\cdot10^{-6}$	$6,5417658\cdot10^{-6}$	$1,0205341\cdot10^{26}$	0,989321021
Plutonium	$4,9634\cdot10^{22}$	$5,9465\cdot10^{12}$	247,7	$1,8630535\cdot10^{17}$	$8,0596802\cdot10^{-10}$	$3,8627539\cdot10^{-6}$	$3,7535832\cdot10^{-6}$	$4,8231223\cdot10^{22}$	0,971737579

Note:

1. Mercury, Venus, Earth, Mars, Jupiter, Saturn, Plutonium: columns 2, 4, 5, 6 from [4].
2. Uranium, Neptunium: columns 2, 4 from [4], column 6 from [6].