Notes to

Heim modification of Newton's law

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Preface

A goal of this essay is the representation of the philosophies of home for the modification of Newton's law. Are those so far admitted critical comments to be considered.

After Heim the gravitation can be understood in the long run only in the 6-dimensionalen space one. He understands gravitational fields in the four-dimensional „experience area " as consequence about structural changes in the Transbereich. Unfortunately a detailed analytic development of this theory is missing in home publications. A first beginning is in [1] (see S. 212ff: To find „hermetri elementary structures "). Heim against it in the years 1955 to 1963 in halfclassical kind with a modification of Newton's law and this concerned itself again and again also in its books in priority place published. To this modification, which repeats in the past cause for controversies discussions gave, to which Heim again and again refers however in its work, should this contribution be limited. It is not discreet that Heim intended to revise this part of its theory again.

Home books [1,2] give a free entrance to this modification and its application, in detail the sections:

- Logical and empirical basis.
- The macroscopic background.
- Gravitational space structures and their extrema,

in the chapters I and II in volume 1 as well as the chapter V „cosmology " in volume 2.

The topic is addressed in different places also in its handwritten drafts, which however at present only a small circle for the order. It concerns here altogether several thousand Pages in 17 volumes.

Introduction to the topic

A term, which plays a substantial role with the modification of Newton's law in addition, generally with discussion „of the Heim theory " again and again one mentions, is „the Mesofeld " (meso: griech. → means… between). Heim this field developed purely mathematically from the temporally variable gravitational field. In the future the Mesofeld was partly doubted and partly mystifiziert. Thus today we that it is identical up to a porportionality factor with gravitomagneti schen field, which itself during linearization of the field-equations of general relativity theory (GRT, Einstein gravitation law) know for the case of weak fields result in. There Mesofeld and gravitational field mutually induce themselves assumed Heim reactions also on the static gravitational field thus on Newton's law.

Newton's law reads with acceptance of a punctiform mass M_0 in the distance r:

(1) *Gravitation potential:* $$\varphi = -\frac{GM_0}{r} \left[\left(\frac{m}{s}\right)^2\right]$$

whereby G = gravitation constant

(2) *Gravitational field strength:* $$|\vec{g}| = \frac{d\varphi}{dr} = \frac{GM_0}{r^2} \left[\frac{m}{s^2}\right]$$

$\vec{g} = -grad\varphi$ stands for an acceleration field radially to central measures. As gradient field it is nonvortical.

Heim the singularity of the equations disturbs (1) and (2) $r=0$. He argued furthermore, the observation that galaxy clusters (when obviously largest unit in the optical universe) depart with increasing speed from each other, would speak also for a modification for very large distances (attraction border ρ).

Heim the approach of Einstein probably knew to supplement the motion equations by additive a member. In the nonrelativistic model results thereby for acceleration in radial direction (see [3], P. 662):

(3) $$\frac{d\varphi}{dr} = -\frac{GM_0}{r^2} + \Lambda\frac{r}{3}$$ Λ stands for the cosmic constant.

Heim looks for a closed and physically begründbaren solution and generalizes therefore the expression for the gravitation potential too:

$$(4) \qquad \varphi = +\frac{GM(r)}{r}\left(1-\frac{r}{\rho}\right)^2 \quad {}_{with}\ \vec{g} = grad\varphi$$

Also Heim radial symmetry assumes. For dimension reasons (square of a speed) it sets the plus sign against the convention consciously. $\mathrm{M(r)}$ (field-reduced) if the central measures, those, referred M_0 to r, are so Heim: „due to the relativity principle gravitational space structures in relative peace is place-dependant ". In other place designates Heim $\mathrm{M(r)}$ explicitly also than Inertial-masses. Would like to exclude relativistically degenerate sources of gravitation Heim. Its goal is thus one xModifikation for strong to very weak fields. The field, which results e.g. theoretically from (1) the equations (2) and for the surface of the sun, is to be called still very weak.

Heim´s gravitational field /Meso field equations

In the following section Heim is indicated field-equations in differential form $(Gln.5-8)$ and directly as the appropriate equations, itself Linearization of the Einstein ones field-equations devoted, compared $(\mathrm{Gln.}5^* - 8^*)$ these are the Internet (wikipedia.org/wiki/gravitoelectromagnetism) taken, home equations its drafts.

$$(5) \qquad \alpha\, div\, \vec{g} = -\sigma \qquad \leftrightarrow \qquad (5^*) \qquad div\, \vec{g} = -4\pi G\sigma$$

$$(6) \qquad \beta\, div\, \vec{\mu} = -\sigma\, div\vec{f} \qquad \leftrightarrow \qquad (6^*) \qquad div\, \vec{B} = \beta\, div\, \vec{\mu} = 0$$

$$(7) \qquad rot\, \vec{g} = -\beta\dot{\vec{\mu}} + \frac{\sigma}{\alpha}\vec{f} \qquad \leftrightarrow \qquad (7^*) \qquad rot\, \vec{g} = -\dot{\vec{B}}$$

$$(8) \qquad rot\, \vec{\mu} = \alpha\dot{\vec{g}} - \sigma\vec{v} \qquad \leftrightarrow \qquad (8^*) \qquad rot\, \vec{B} = \frac{1}{\omega^2}\left(\dot{g} - 4\pi\sigma\vec{v}\right)$$

Mean in detail:

α, β: Field constant; $\vec{g}, \vec{\mu}$: gravitation .Mesofeld; $\vec{B}$: gravitomagnetisches field;

$\dot{\vec{g}}, \dot{\vec{\mu}}, \dot{\vec{B}}$: Time derivatives; σ : differential mass density; $\vec{v}$: Velocity field;

$\sigma\vec{v}$: Mass current density; $\vec{f}$: Auxiliary function; div and red are vector operators also their assistance statements to the swelling and eddy strength of vector fields to be met know.

The differential mass density σ can take values with < 0 Heim.

In equation 8^* has ω the value of the speed of light (c). For α and β the connection Heim generally results after: $\alpha\beta\omega^2=1$. Purely formally can do β one positive value (wave propagation) or a negative value (propagation of a potential disturbance with imaginary speed) take. To the sign of β wanted not to commit itself Heim in [1] and [2]. There are however references, in particular with study university of its drafts that he to $\beta < 0$ tended.
Due to an operator error with the computation of the field constant α received Heim in the consequence for $|\omega|$ the value $\frac{4}{3}c$. This value is to be found still in its books. In order to bring the different propagation speeds in agreement with its conviction that a photon is always accompanied by a graviton, design Heim two areas, whose cross-setting represents our world. In the consequence with $|\omega| = c$ one goes out.

One selects the values of the vacuum for the field constants:

$$\alpha_0 = \frac{1}{4\pi G} = 1.192\ 10^9 \left[\frac{kg\ s^2}{m^3}\right] \qquad \beta_0 = \frac{4\pi G}{|\omega^2|} = 9{,}3215\ 10^{-26} \left[\frac{m}{kg}\right] !$$

thus the two sets of equations up to (speculative) the vector function are correct $\vec{f}$

(Gln. 5+6). If $\vec{f}$ a cyclic field is, which is to be assumed, the right Page of equation reaches (6) zero likewise.

Heim defines similarly to the electrical characteristic wave impedance of the free space $(Z_L=376.73\Omega)$ a characteristic wave impedance of the gravitation:

$$Z_G = \sqrt{\frac{\beta_0}{\alpha_0}} = 2.796437\ 10^{-18} \left[\frac{m^2}{kgs}\right]$$

It is shown that the condition (of transverse) gravitation waves very strong Mesofelder is:

$$|\vec{\mu}_t| = \frac{|\vec{g}_t|}{Z_G} = 3.57\ 10^{17}\ |\vec{g}_t|$$

Equation (5) is called „Poissongleichung ". It is principal equation for the determination of the static gravitational field for the case of weak fields. Also the equations (1) and (2) can be derived (5) also.

Home modified Newton's law

Like initially already mentioned proceeds Heim from the simplest case of a mass relativistically not degenerated M_0 and looks for a modified solution for small and very large distances of the central body M_0. Heim the boundary condition sets: $M_0 = M(r_0)\, r_0$ by a volume V_0 one defines, which M_0 encloses fully. The uniform radius ρ of the attractive effective range assumed by him decreases/goes back after its conception only to the microstructure and/or the middle mass m_0 of the atomic last-units of the central body $(M_0 = Lm_0)$. Elementary gravitational fields and/or Field-quantums are to be assigned to the last-units, which lead in such a way to a quantum structure of the gravitational field. Energy and wavelength $\lambda = 2\varrho$ of individual Feldquants computed Heim from the change Δm of the mass $\mathrm{m(r)}$ within the range $\hat{r}_0 \leq r \leq \rho\, \hat{r}_0$ is the radius of the Last-unit. λ and ρ are to be expected in cosmic orders of magnitude. According to equation (4) generally arises for the potential field:

$$(9) \qquad \varphi = G\frac{Lm(r)}{r}\left(1-\frac{r}{\rho}\right)^2 \quad L = 1{,}2 \ldots\ldots N$$

For the determination of the functions $\mathrm{M(r)}$ and $\varphi(r)$ needs Heim apart from (4) a second equation. He finds these by application of the principle of conservation of energy:

$$(10) \qquad M(r)c^2 + E_g + E_\mu = M_0\, c^2$$

E_g *and* E_μ stand for the gravitation and Mesofeldenergiebeträge in the space range, for that by the variable one $\bar{r}$ one defines how: $r_0 \leq \bar{r} \leq r$. Heim Glei calls
chung (10) „macroscopic energy principle in the gravitational field with consideration of the unit of field and source ". With this step Heim the speed of light introduces into its theory.

The field energies derives Heim from the equations (7) and (8). It receives:

$$(11) \qquad M(r)c^2 + \frac{\alpha}{2}\int_{r_0}^{r} \vec{g}^2\, dV + \frac{\beta}{2}\int_{r_0}^{r} \vec{\mu}^2\, dV = M_0 c^2$$

whereby dV the volume element $dV = 4\pi\bar{r}^{\,2} d\bar{r}$ represents. In the case of accelerated Mas sen within V_0 can the gravitational field $\vec{g}$ additive from a gradient field and a cyclic field $\vec{A}\ \ (rot\vec{A} \neq 0)$ be built up. Thus equation goes (11) over into:

$$(12) \qquad M(r)c^2 + \frac{\alpha}{2}\int_{r_0}^{r} (grad\varphi)^2\, dV$$

$$\pm \int_{r_0}^{r} \left[\frac{|\beta|}{2}\vec{\mu}^2 \pm \frac{\alpha}{2}(\vec{A}^2 + 2\vec{A}grad\varphi)\right] dV = M_0 c^2$$

In equation (12) the cases ($\beta<0$ minus signs) are discussed $\beta>0$ and. Heim decides for the case $\beta<0$.
Subsequently, it simplifies the integrand of the second integral (power density) after a set of η considerations again:

$$(13) \qquad \eta = \frac{c^2}{F_\rho}\frac{dM(r)}{dr} \quad \textit{where:}\ F_\rho = 4\pi\rho^2$$

the boundary surface of the attractive range is. With this beginning can be written for (12) equation:

$$(14) \qquad M(r)c^2 + \frac{\alpha}{2}\int_{r_0}^{r} (grad\varphi)^2\, dV - \frac{c^2}{F_\rho}\int_{r_0}^{r} \frac{dM(\bar{r})}{d\bar{r}}\, dV = M_0 c^2$$

After differentiation of equation (14) the <u>principal equation of</u> its modification Heim finally receives:

$$(15) \qquad c^2\frac{dM(r)}{dr} + 2\pi\alpha r^2\left(\frac{d\varphi(r)}{dr}\right)^2 - c^2\left(\frac{r}{\rho}\right)^2\frac{dM(r)}{dr} = 0$$

With beginning (4) has Heim thereby 2 equations for the regulation of $\varphi(r)$ and $M(r)$ the solutions, which it receives, are difficult transcendental nature and to analyze.

$\varphi(r) = f_1[\varphi(r), M_0, \rho, \alpha, c]$ *and* $M(r) = f_2[\varphi(r), M_0, \alpha, c]$ see plants 1 +2.

The function $\varphi(r) \geq 0$ is real only in $r_- \leq r \leq r_+$ the range. Theore result table thus two Ereignishorizonte r_- and r_+ , whereby the following connection exists:

$$(16) \qquad r_- r_+ \approx \rho^2$$

The Ereignishorizonte are connected with very strong fields. Their numeric regulation is therefore incorrect with security. Purely computationally does not arise for r_- (ρ here necessarily):

$$r_- = 2e\frac{2GM_0}{c^2} \quad \textit{with} \propto = \frac{1}{\pi G}: \quad \textit{field constant of the GRT}$$

$$r_- = e\frac{2GM_0}{c^2} \quad \textit{with} \propto = \alpha_0$$

The correct solution is the black sign radius:

$$r_{sr} = \frac{2GM_0}{c^2}$$

The regulation of ρ requires after Heim the investigation the Inertial-masses and/or relative mass m(r) for the case of an atomic Last-unit m_0 (L=1 in equation (9)). As suggested he evaluates the decrease in the interval above M(r) with the help of m(r) the far field solution Δm for and/or $\hat{r}_0 \leq r \leq \rho$ and from it the energy Δmc^2 of a solid graviton derives, whose wavelength λ coins/shapes according to its opinion the fundamental process of the Gravitationspotenzials. As is the case for a photon sets Heim:

$$(17) \qquad \lambda = 2\rho = \frac{h}{\Delta m\, c}$$

whereby λ the Comptonwellenlänge too Δm and h the Planck constant finally is and for ρ:

$$(18) \qquad \rho = \frac{h^2}{8aGm_0^3} \quad \textit{with}\ a = \pi\alpha G$$

Result also the radius of m_0 would enter. These eliminated Heim however through equate with the half Comptonwellenlänge of m_0. If one selects for m_0 the mass of the proton, then a value ρ of approx. light-years results 10^7 for. This value results also with the formula:

$$(19) \qquad \rho_p = \frac{1}{8a}\frac{\lambda_p}{\alpha_G}$$

where: λ_p the Comptonwellenlänge of the proton and α_G in astrophysics used and on the proton referred fine structure constant of the gravitation is likewise.

Thus the modification is final. The obtained solutions are for Heim starting point with the treatment of a set of problems of the cosmology. He comes to plausible results, with which is not to be dealt more in greater detail here.

Written comments on home solution

There is a set from critical, in writing seized comments to home modification of Newton's law [5-8]. The substantial aspects are to be shown here. In the next section comments of the author of this contribution follow.

[5] vorausge refers in $\rho \to \infty$ the case, the Heim with $E_\mu \ll E_g$ the default

hend treated. It is proven that home beginning for $\varphi(r, \rho \to \infty)$

$$\varphi(r) = \frac{GM(r)}{r}$$

the Poissongleichung (5) only for very weak fields fulfills. It is valid:

$$(20) \qquad \alpha_0\, div\big(grad\varphi(r)\big) = -\sigma(r)\text{, also } \sigma(r) = \frac{1}{4\pi r^2}\frac{dM(r)}{dr}$$

The differential mass density $\sigma(r) \leq 0$ is not in the available case material masses

seals will separate as field mass density designated, since it is assigned to the differential field power density. For equation (20) directly a solution can be indicated, if $-\sigma(r)$ more strongly than the function $f=1/r$ against zero converges:

$$(21) \qquad \varphi(r) = \frac{GM_0}{r} + G\int_{r_0}^{r} \frac{\sigma(\bar{r})}{r} 4\pi\bar{r}^2 d\bar{r} + G\int_{r}^{\infty} \frac{\sigma(\bar{r})}{\bar{r}} 4\pi\bar{r}^2 d\bar{r}$$

and/or by definition:

$$(22) \qquad \varphi(r) = \frac{GM(r)}{r} + G\int_{r}^{\infty} \frac{\sigma(\bar{r})}{\bar{r}} 4\pi\bar{r}^2 d\bar{r}$$

From this it follows directly that the beginning of home for $\varphi(r)$ only thus values large for very weak fields is valid r, where the contribution of the integral can be neglected.

[6-8] a fundamental is investigation of the Heim modification of Newton's law from view of the art. starting point is the lecture, the Heim 1976 at the company MBB held and in the Internet to find is (see also [4] Page 81) as well as specified above the sections in [1], direct ones of comparisons refer also here only in the case $\rho \to \infty$. The following results are called:

- For the solution of the differential equation from the MBB lecture (' $\alpha = \frac{3}{64\pi G}$) no agreement with the field-equations and/or field solutions of the GRT exists.
- There is an agreement in first order with weak fields, if for α the appropriate value of the GRT is taken over (plant 1).
- An agreement because of first and second order exists, if in place of the Heim beginning (4) for $\varphi(r)$ the beginning (23) is used.

$$(23) \qquad \frac{d\varphi(r)}{dr} = -\frac{GM(r)}{r^2}$$

This beginning can be won by differentiation of (21) equation (simplest from (20) equation d.A.). It carries together with the principal equation (15) $\rho \to \infty$ to a simple differential equation for the function $\mathrm{M(r)}$, which is integrated however not in $r_0 \le \bar{r} \le r$ the interval but in $\infty \ge \bar{r} \ge r$ the interval. That corresponds the aspect of the GRT, since the Inertial-masses $\mathrm{M(r)}$ only by a stationary observer, who is $\mathrm{r} \to \infty$ with ($\mathrm{r} = \rho$! and/or) at a gravitational field-free place, to be determined can. Thus a dependence on r_0 is avoided. Initial value $\mathrm{M}(\rho)$ is (point) the mass M_0. The field solution $\varphi(r)$ agrees with the solution of the astrophysicist K. black sign (1873-1916), these from the

Einstein ones field-equations for the gravity field of a material point won (see plant lund plant 2). Thus also the black sign radius (Ereignishorizont r_-) is correctly shown.

The investigations in [6-8] treat however also the case $\rho < \infty$. A suitable
Extension from beginning (23) becomes in

$$(24) \qquad \frac{d\varphi(r)}{dr} = -\frac{GM(r)}{r^2}\left(1-\left(\frac{r}{\rho}\right)^2\right)$$

seen and as „corrected home beginning " designates. This beginning präjudiziert a sign change $r=\rho$ and turns into for $r \to \infty$ in equation (23). Together with Equation (15) results now a set of equations, which is to be solved in the comparison to the Heim approach likewise substantially more simply (plant 1). Since the solutions $\varphi(r)$ agree $M(r)$ ***and*** within the range of very weak fields with that Heim, the relationship for ρ does not change. Also the connection (16) does not change. The Ereignishorizont r_- corresponds again to the black sign radius. Relative r_+ it is speculated whether it concerns (Hubble) r_H the radius of the optical universe. For the case $r \to r_-$ ***and/or*** r_+ in each case the limit value results $M(r) = \infty$, as it those GRT requires.

In [6-7] also thereupon-pointed that the equations of the GRT lead to a similar process it is indicated, as in (24) equation, if for the differential mass density formally the expression

$$(25) \qquad \sigma(r) = -\frac{M_0}{2\pi\rho^2 r}$$

one accepts. It concerns here <u>not</u> around a field mass density but, as usual in the GRT, a density, which is derived from a material measure and a pressure distribution.

If one inserts equation (25) into the Poissongleichung (20), then arises:

$$(26) \qquad \frac{d\varphi(r)}{dr} = -\frac{GM_0}{r^2}\left(1-\left(\frac{r}{\rho}\right)^2\right)$$

An estimation of the portion the much discussed „dark energy " leads with this process and the acceptance $2\rho = r_H$ too much good results.

In [8] still another contradiction in the hypothesis of home is finally determined. Equation (13) results in inadmissible positive $r > \rho$ power densities within the range, there $\mathrm{M(r)}$
again rises.

When a solution presented way out of this dilemma, which proceeds directly from the complete $(5 - 8$ set of equations $5^* - 8^*)$ ***and/or***. The time-dependant cyclic field $\vec{A}$ is accepted direction-independent however normally to $\vec{r}$ the radius vector:

$$(27) \qquad \vec{A} = \vec{A}(r,t) = A(r)\{sin(\omega t)\vec{e}_\theta + \cos(\omega t)\vec{e}_\Phi\}$$

The field solutions obtained after extensive analysis are very similar to the corrected home solution (zero crossover, two Ereignishorizonte). Approximation solutions result in an agreement with other theories, so also a process for (25) the estimation $\sigma(r)$ of the portion of the dark energy, comparable with equation.

Comments of the author

Fundamental remarks on the Mesofeld

First it is necessary to deal again with home $(5\text{-}8)$ set of equations. No reference works in its writings, which would make it possible to arrange its relevant considerations correctly, are. It is interesting that Heim in its drafts still of a Mesofeld speaks, later then in its books only more from an auxiliary vector field. Heim probably assumes a new field to have found. It is actually discussed however already in the GRT Einstein (1916), after already Maxwell (1865) and Heaviside (1893) refer to gravitation waves and/or connect these with the necessity for a second field apart from the gravitational field. The linearization of the Einstein ones field-equations for weak fields happens however only 1963 and that probably first (indirect) proof in the laboratory 2001 with the experiment of Taymar and De Matos [9].

The equations $(5\text{-}8)$ can be won also from views of analogy. Behind it a universal law probably hides itself according to which generally physical fields in a given volume is in such a way formed that the field energy content for given boundary conditions becomes a minimum. That should be valid for the Mesofeld and the gravitational field exactly the same as for the magnetic and the electrical field.

As can be simply reconstructed, the equations result(5-8) actually directly from the Maxwell equations to free space, if to place of of the electrical dimensions [ampere] and [volts] the dimensions [kilograms/second] and [(meters/second) 2] $\hat{=}$ ***gravitation potential*** to be set. Thus the following correspondences result:

Elektrisches Feld $\vec{E}$ [$\frac{V}{m}$]	↔	Gravitationsfeld $\vec{g}$ [$\frac{m}{s^2}$]
Magnetisches Feld $\vec{H}$ [$\frac{A}{m}$]	↔	Mesofeld $\vec{\mu}$ [$\frac{kg}{sm}$]
Elektrische Feldkonstante ϵ [$\frac{As}{Vm}$]	↔	Feldkonstante α [$\frac{kgs^2}{m^3}$]
Magnetische Feldkonstante μ [$\frac{Vs}{Am}$]	↔	Feldkonstante β [$\frac{m}{kg}$]
Ladungsdichte ρ [$\frac{As}{m^3}$]	↔	Massendichte σ [$\frac{kg}{m^3}$]
Stromdichte $\vec{J}$ [$\frac{A}{m^2}$]	↔	Massenstromdichte $\sigma\vec{v}$ [$\frac{kg}{sm^2}$]

As to be expected relations for forces, achievements and energies changes into in each case such, like e.g. with the dimension transformations specified above:

Coulombkraft	↔	Gravitationskraft
Lorentzkraft im magnetischen Feld	↔	Lorentzkraft im Mesofeld

The algebraic structure of the appropriate laws is alike. According to the present text book opinion however the important physical difference exists that between masses are effective excluding attraction, while the carriers of electrical loads tighten each other and push off, according to whether they are ungleichnamig or loaded of the same name. This vermeindiche discrepancy is reliably because of the fact that true nature is so far not understood about mass and Charge.

In the case of the acceptance $\vec{f} = \vec{0}$ actually complete results for $(5\text{-}8)$ the equations
Agreement with the Maxwell equations is accepted if negative charge density and physical direction of current.

Gravitation waves (potential disturbances) develop or for positively accelerated mass movements theoretically through negatively. The mass inertia can be understood as self induction process. A homogeneously moved mass flow (e.g. rotation) produces a static Mesofeld (without radiation), which can be compared with the permanent magnetism. If a second mass flow in this field moves, then attraction or repulsive forces results proportionally to the strength of the Mesofeldes, the strength and speed of the mass flow as well as as a function of the enclosed angle between the directions of Mesofeld and mass flow depending upon direction of motion. Porportionality factor is the field constant β_0, which has a very small amount. It is to be assumed however Mesofelder, which are produced by galaxies in the interior and external areas produce additional forces, which cannot be neglected. Neighbouring galaxies with same direction of rotation would have to repel themselves or tighten, depending upon which whether their neighborhood is equatorial or polar. Also the flattening from ball galaxies to disk galaxies could be the effect of Lorenz forces in Mesofeldern.

After Heim the Mesofeld plays an important role as proximity effect field also with the education of elementary masses as well as in the atomic nucleus (like e.g. repulsive „strong strength " between neighbouring nucleons due to the very small distance and same Eigenspin (d.A.).

Notes to modified Newton's law

Because of changed limitss of integration $(r_0 \to \infty)$ the verification of the black follows
sign solution in [8] not accurately the solution method Heinis. This is briefly retrieved become-hurries. Starting point the equations are (23) and (15). By elimination of
$\frac{d\varphi(r)}{dr}$ develops a differential equation for $\mathrm{M(r)}$, which is to be solved simply:

$$(27) \qquad \int_{M_0}^{M} \frac{dM(r)}{M(r)^2} = \frac{2Ga}{c^2} \int_{r_0}^{r} \frac{1}{r^2} dr \qquad a = \pi\alpha G$$

After integration and dissolution $M(r)$ results in:

$$(28) \qquad M(r) = \frac{M_0}{1 + r_{sr} a \left(\frac{1}{r_0} - \frac{1}{r}\right)} \quad \textit{with:} \quad r_{sr} = \frac{2GM_0}{c^2}$$

From equation (28) follows directly: $M(r_0) = M_0$. The Ereignishorizont $r = r_-$ it formally gives oneself from the limit value:

$$(29) \qquad \lim_{r \to r_-} M(r) = \infty \qquad \to \qquad r_- = \frac{a r_{sr} r_0}{a r_{sr} + r_0}$$

In such a way one selects for The $a=1$ value (GRT) approaches r_- for not relativistic len $(r_0 > r_{sr})$ very fast the black sign radius of the art. it can therefore be assumed also the gravitation potential and the gravitational field approach the solutions of black sign (see plant 1). The result is to be evaluated quite positively, since with this solution the problem of a material point is avoided. If one considers that black sign won its solution from the complex in steinschen field-equations, then the way of home is as very simple to designate. General conclusions must be still drawn from it.

In order to manufacture compatibility with the GRT, „the macroscopic energy principle of " home (see equations and (10)) (11) would have to be rewritten:

$$(30) \qquad M(r)c^2 = M_0c^2 + E_g + E_\mu = M_0c^2 + \frac{\alpha}{2}\int_{\rho}^{r} \vec{g}^2\, dV + \frac{\beta}{2}\int_{\rho}^{r} \vec{\mu}^2\, dV$$

With view of home modification of Newton's law for large r now the fundamental question rises whether Mesofeldprozesse can affect the static part $\vec{g}$ of the gravitational field of a nonrelativistic, M_0 insulating mass in such a way that starting from a distance $r = \rho$ again an increase of the Potenzials is to be registered. The static gravitational field is time-independent by definition. Weak static Mesofelder and gravitational fields are decoupled because of (5) equations (6) and. A time-dependant Mesofeld induces a time-dependant gravitational field (cyclic field), i.e. the overlay with the static gravitational field is likewise time-dependant.

Before this background the conception of home, which led to the introduction of the parameter ρ, appears as speculative. It präjudiziert with beginning (4) a zero in the gravitational field $r=\rho$, without securing these in the range of validity of (5) equation. Also the corrected beginning actually fulfills (24) equation (5) without restriction of the function $M(r)$ approximate only within the range $r \ll \rho$, but not, if r is the order of magnitude ρ of reached $r > \rho$ or. This shows up with development of

Equation (20):

$$(31) \qquad \frac{\alpha_0}{r^2}\frac{d\left[r^2\left(-\frac{GM(r)}{r^2}\left(1-\left(\frac{r}{\rho}\right)^2\right)\right)\right]}{dr} = -\sigma = -\frac{1}{4\pi r^2}\frac{dM}{dr}$$

and/or.

$$(32) \qquad \frac{1}{4\pi r^2}\frac{dM(r)}{dr} - \frac{1}{4\pi\rho^2}\left(\frac{dM(r)}{dr} + \frac{2M(r)}{r}\right) = \frac{1}{4\pi r^2}\frac{dM(r)}{dr}$$

If one refrains from $\rho \to \infty$, then there is only a certain process $M(r)$, the equation

(32) in the entire range of validity fulfills. In addition the bracketed term must reach zero. This demand leads on the conditions:

$$(33) \qquad M(r) = \frac{C}{r^2}, \quad \frac{dM(r)}{dr} = -\frac{2C}{r^3}, \quad \sigma = -\frac{C}{2\pi r^5}$$

with integration constant $C \geq 0$

The solutions $M(r)$ of the sets of equations $(4+15)$ and/or $(24+15)$ are sufficient this fuel element hiring within the critical r- ranges not. Approximation solutions would result, if the expression

$$(34) \qquad -\frac{1}{4\pi\rho^2}\left(\frac{dM(r)}{dr} + \frac{2M(r)}{r}\right)$$

to be neglected can. Superficially regarded this should in particular within the range $r \to \rho$ with the approximations:

$$\frac{dM(r)}{dr} \approx 0, \quad M(r) \approx M_0$$

possible its. The remainder member becomes however identical the expression of equation (25) and is thus not negligible.

Thereby are all solutions with a finite -ρ value wrong?

Equation (3) is confirmed in the meantime also by astronomical measurements. The correction term therefore decreases/goes back to a force component, which is not clarified until today. Total acceleration decreases/goes back thus to the effect from two different fields. It does not surprise therefore that also equation (3) does not fulfill the Poissongleichung. From this view, it is probably wrong to demand solutions which fulfill the Poissongleichung in the entire definition range also.

The fundamental agreement of the Heim solution with (apparent) the potential process, which can be derived (3) from equation, is an explanation for the fact that Heim the Hubblekonstante can successfully deduce.

For the conclusion of this section it is necessary to address the dilemma concerning (13) equation.

The considerations, which Heim employed during the derivative of this equation, have a partially speculative character. The step from equation (12) to equation (13) can be however quite interpreted as consistent use of the field measure term for the remainder field summarized in the square brackets. Its energy content is directly proportional a change of the relative mass, whereby the porportionality factor straight is selected in such a way that the solutions of the principal equation (15) in the place $r = \rho$ have determined characteristics. In [1] (Page 84) the condition formulates Heim explicit $\frac{dM(r)}{dr} \leq 0$, in order to exclude a positive field mass density. The injury of this demand within the range $r > \rho$ by all past solutions $M(r)$ can be however formally corrected, if one during the derivative of equation (15) not $\beta < 0$ but $\beta > 0$ (wave propagation!) selects. Thus the sign third changes Member of equation (15). By simply transforming of the differential equation one recognizes immediately that above condition is always fulfilled.

With beginning(24)one receives as very good approximation solutions $(r_{sr}a \ll \rho)$:

$$(35) \qquad M(r) = \frac{M_0}{1 - \frac{r_{sr}a(1 - \left(\frac{r}{\rho}\right)^2}{r}}$$

where: $a = \pi\alpha G \qquad r_{sr} = \frac{2GM_0}{c^2}$ (Schwarzschild radius)

and

$$(36) \qquad \frac{d\varphi(r)}{dr} = -\frac{1}{r^2}\frac{GM_0(1 - \left(\frac{r}{\rho}\right)^2)}{1 - \frac{r_{sr}a(1 - \left(\frac{r}{\rho}\right)^2)}{r}}$$

As to be expected, the solutions are correct $(35)$and$(36)$for$r \ll \rho$ with the corrected

, But the sharp Ereignishorizont is missing to home solutions$r_+ r \gg \rho$. In plant 2 are diagrams to find (illustrations 4 and 5) to the process in principle$(36)$of the acceleration function as well as the potential process resulting from it. It is noticeable that acceleration (differently than in the case$\beta < 0$) strives for the signs reversal fast against a relative maximum, in order to then decrease slowly again. A similar process Heim in his MBB lecture described. The potential process curves therefore with increasing radius downward unequally the Verlaul in illustration 2, which curves upward. The potential function, which can be derived from$(3)$the empirical equation, results in a square curvature upward for very large distance.

Also equation(36)does not fulfill the Poissongleichung!

Summary and conclusion

In the fifties Heim its modification of Newton's law develops on the basis of a set of ideas. It concerns thereby in detail the following statements:

- Apart from the gravitational field the Mesofeld exists as the second field,
- the Field-masses must be included into the computation of the gravitational field,
- Field and source connect the macroscopic energy principle (principle of conservation of energy),
- the potential field is coined/shaped by Field-quantums.

Independently of (relatively small) errors, which in-crept during the elaboration of the modification, the validity of the first three statements can be confirmed. For the special case the infinitely far attraction border results for the corrected solution agreement with the black sign solution. Statement four cannot be evaluated finally. An open question is also, to what extent the found potential processes in the entire definition range must fulfill the Poissongleichung. An open question is also the influence of an additionally existing material mass density on the Heim solutions.

The found solutions are to a large extent before-coined/shaped by the beginnings. A less pre-defined approach is the closed solution of the complete set of equations. The aids, which are needed for the numeric evaluation, are in the meantime substantially further advanced as in the fifties. In [8] this path is taken. It is not clear however yet, whether the obtained solution, those is to the Heini solution, seen from the field process in principle, very similar, a material physical background has. The cyclic field $\vec{A}$ is direction-independent and with uniform rotational frequency set. It is noticeable that in the source area the amplitude of the cyclic field must be in the order of magnitude of the Gravitationspotenzials. As expected the amplitude of the Mesofeldes is here still very much larger. For the achievement of the solution an extensive variation of the initial values is necessary.

These results as well as new investigations too „black holes " let assume that after Mesofeld Heim (and/or the gravitomagnetische field after Einstein) actually an important role in the cosmic happening plays. The following considerations support this assumption:

The entire matter in the cosmos is in (more increasingly!) Movement. There is rotation to observe rotating and propagation movements from masses to. This is valid for the macrocosm and for the Mikrokosmos. The associated kinetic energy is source energy of Mesofeldern, which exercise

Lorentzkräfte additionally to the normal gravitation forces. These should lead because of the extremely long time arrow to measurable effects.

A thought of Heim, which was so far not mentioned, however in particular in the relativistic range of importance to be must, is the coupling of gravitation and Mesofeld with the electromagnetic field. Heim e.g. for a fast rotating dielectric mass a magnetic field derived. A simple explanation, which does not have to fall back to the 6-dimensionalen of space home, could be the acceptance of equivalent Field-masses also for the electromagnetic fields (also [10], chapter 7 compared, Page 227ff: The Dynamics OF general Relativity, R.Arnowitt, S. Deser, C.W. Misner). For analogy reasons there would have to be generally also a field load.

Finally it is to be wished that the extremely interesting work of home does not have existence to the Kos like ever. They developed on the basis of its modification of Newton's law and give not only information for the emergence of the cosmos and to its age but also for the change of the natural constants as a function of the increasing diameter of the entire universe. Afterwards physical dimension are like the Planck - mass and - Charge or the product of gravitation constant and dielectric constant genuine i.e. time-independent natural constants and not the different field constants, the speed of light or the quantum of action.

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Appendix 1: Compilation of the most important formulas

	Heim beginning	
Differential equation $a = \pi \alpha G$	$\left(\frac{d\varphi}{dr}\right)^2 + \frac{c^2}{2a} H \left(\frac{d\varphi}{dr} + H\varphi\right) = 0$ $rH = \frac{\rho + r}{\rho - r}$	
Gravitation potential $\varphi(r)$ $\varphi(r)_{schwach}$	$qe^{-q} = \frac{4aGM_0}{c^2} \frac{\left(1 - \frac{r}{\rho}\right)^2}{r}$ $q = 1 - \sqrt{1 - \frac{8a}{c^2} \varphi(r)}$ $\approx \frac{GM_0}{r} + \frac{2}{c^2}\left(\frac{GM_0}{r}\right)^2 \quad \rho \to \infty, a = 1$	
Gravitational field strength $\frac{d\varphi(r)}{dr}$	$-GM_0 \left(\frac{1 - \left(\frac{r}{\rho}\right)^2}{r^2}\right) e^q$	
Inertial-masses M(r)	$\frac{M_0}{2}(2 - q)e^q$	

	„Corrected Heim beginning "	Schwarzschild solution (ART)
	$\frac{d^2\varphi}{dr^2} + \frac{2}{r\left(1-\left(\frac{r}{\rho}\right)^2\right)}\frac{d\varphi}{dr} \pm \frac{2a}{c^2}\left(\frac{d\varphi}{dr}\right)^2 = 0$	$\frac{d^2\varphi}{dr^2} + \frac{2}{r}\frac{d\varphi}{dr} + \frac{2}{c^2}\left(\frac{d\varphi}{dr}\right)^2 = 0$ $\rho \to \infty,\ a = 1$
	$\pm\frac{c^2}{2a} ln\left(1-\frac{2a}{c^2}\frac{GM_0}{r}\left(1-\frac{r}{\rho}\right)^2\right)$ $\pm\frac{c^2}{2a} ln\left(1-\frac{ar_{sr}}{\left(1+\frac{ar_{sr}}{r_0}\right)r}\right)$, *if:* $\rho \to \infty, \quad \frac{2GM_0}{c^2} = r_{sr}, \quad r \geq r_0$ $\approx \mp\left(\frac{GM_0}{r} + \frac{1}{c^2}\left(\frac{GM_0}{r}\right)^2\right), \rho \to \infty, a = 1$	$\frac{c^2}{2} ln\left(1-\frac{2}{c^2}\frac{GM_0}{r}\right)$ $\varphi_{ART} = c^2\left(1-e^{-\frac{\varphi}{c^2}}\right)$ $\approx -\frac{GM_0}{r} - \frac{1}{c^2}\left(\frac{GM_0}{r}\right)^2$
	$\pm\frac{\frac{GM_0}{r^2}\left(1-\left(\frac{r}{\rho}\right)^2\right)}{1-\frac{2a}{c^2}\frac{GM_0}{r}\left(1-\frac{r}{\rho}\right)^2}$	$\frac{\frac{GM_0}{r^2}}{1-\frac{2}{c^2}\frac{GM_0}{r}}$
	$\frac{M_0}{1-\frac{2a}{c^2}\frac{GM_0}{r}\left(1-\frac{r}{\rho}\right)^2}$	$\frac{M_0}{1-\frac{2}{c^2}\frac{GM_0}{r}}$

Appendix 2: Diagrams

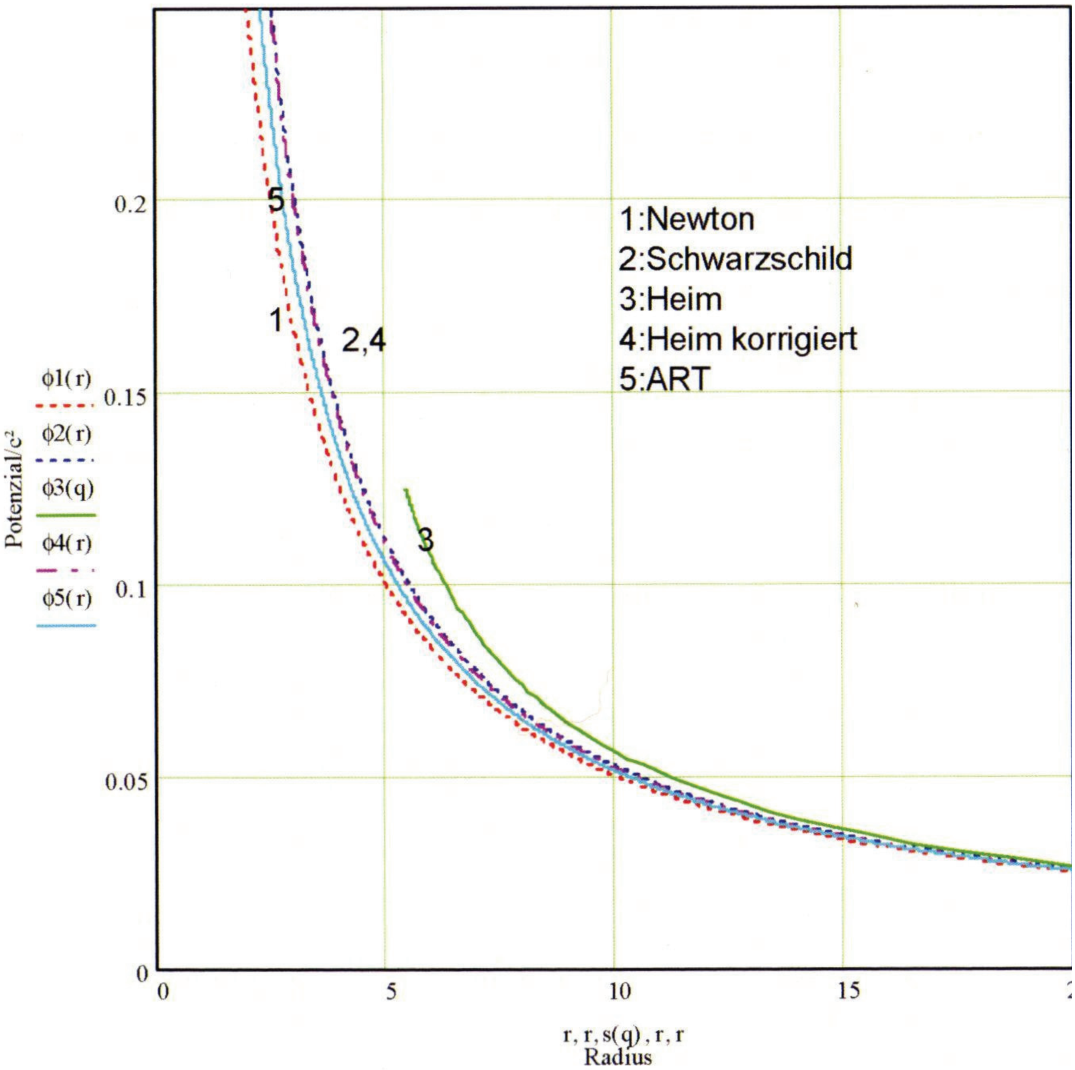

Illustration 1:

Comparison of the standardized potential processes for the different solutions

$$\rho \to \infty, r_{sr} = 1[LE], r_0/r_{sr} = 100, a = 1, (\emptyset 5/c^2)_{max} = 1$$

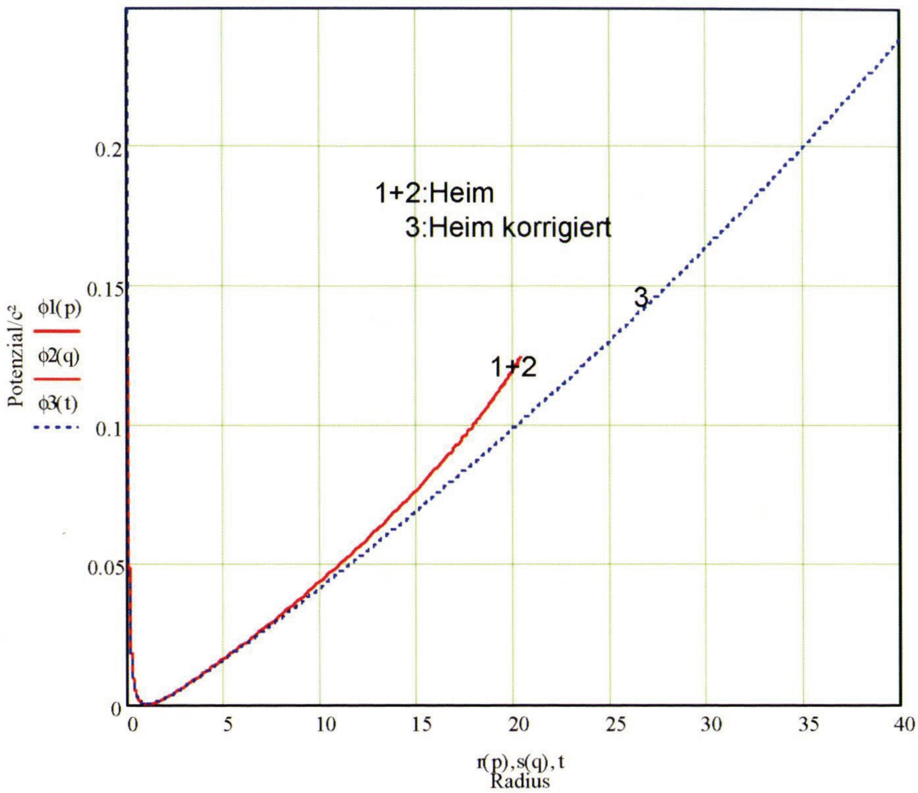

Illustration 2:

Fundamental process of the Heim Gravitationspotenzials

$$\rho = 1[LE], r_{sr} = 0.01[LE], a = 1$$

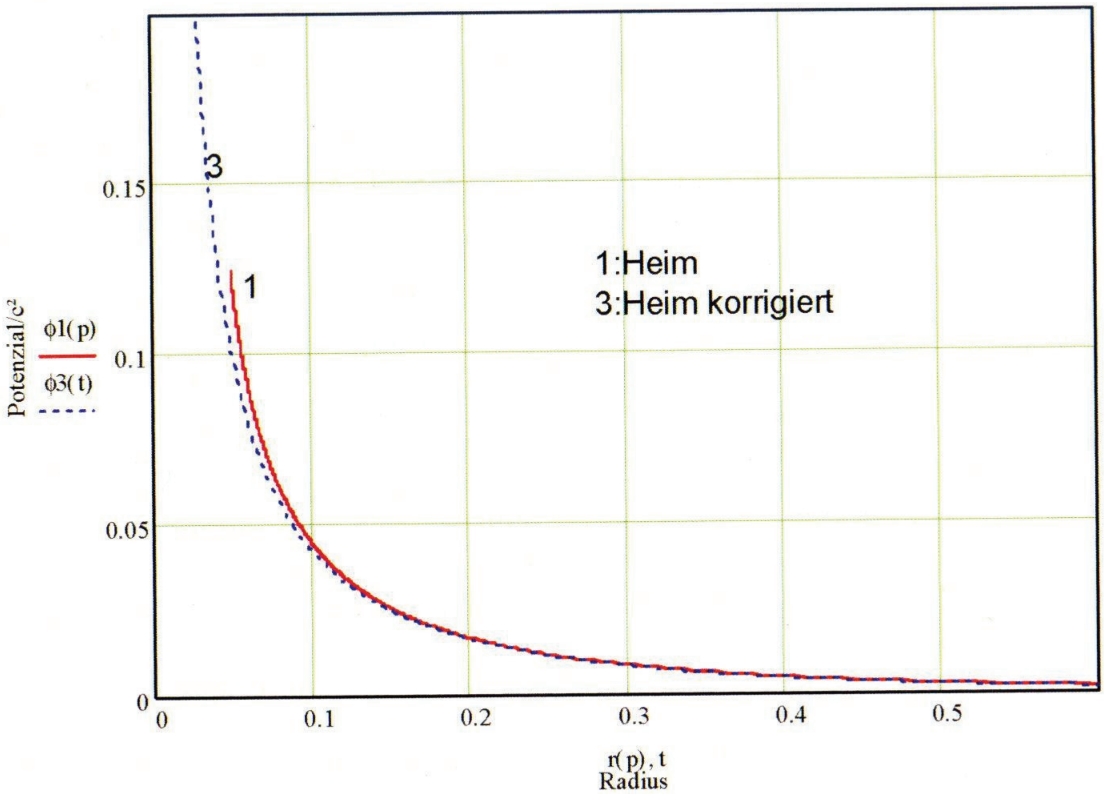

Illustration 3:

Fine dissolution of the Gravitationspotenziale after illustration 2 for $r>0.2p$

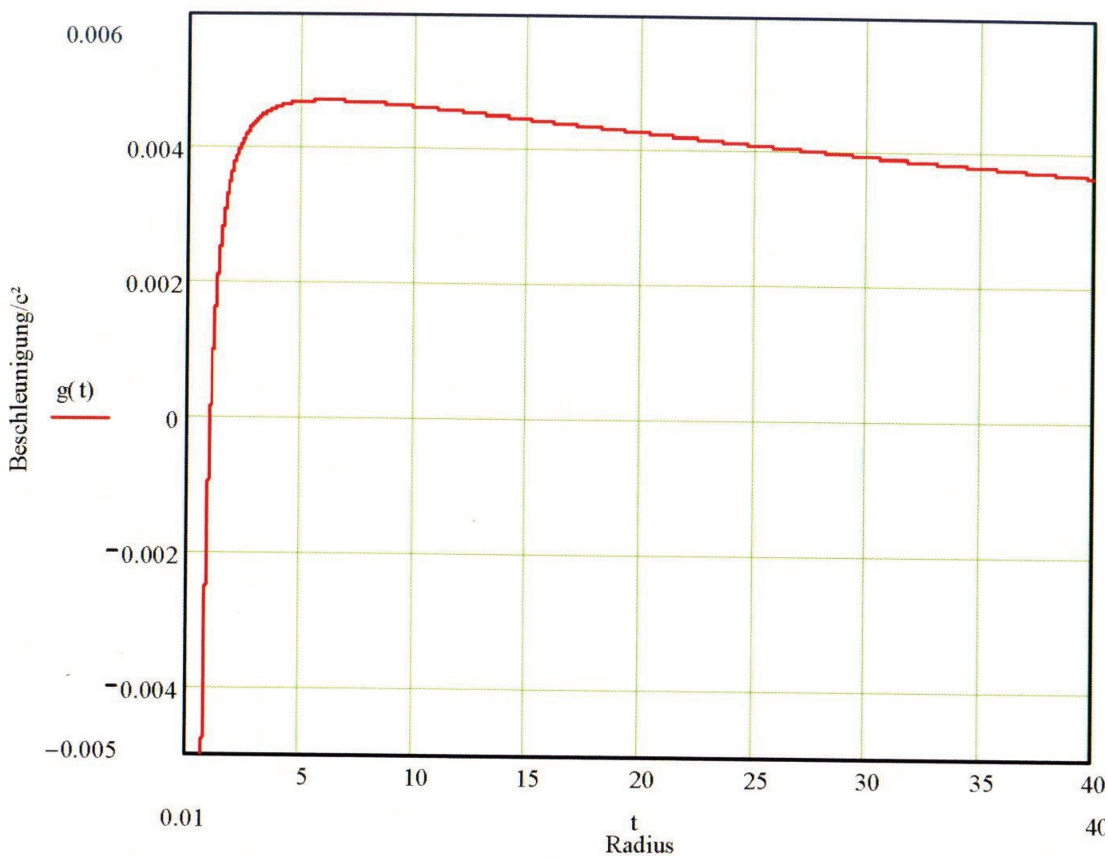

Illustration 4:

Place-dependentness of the acceleration function in the case $\beta > 0$

$$\rho = 1[LE], r_{sr} = 0.01[LE], a = 1$$

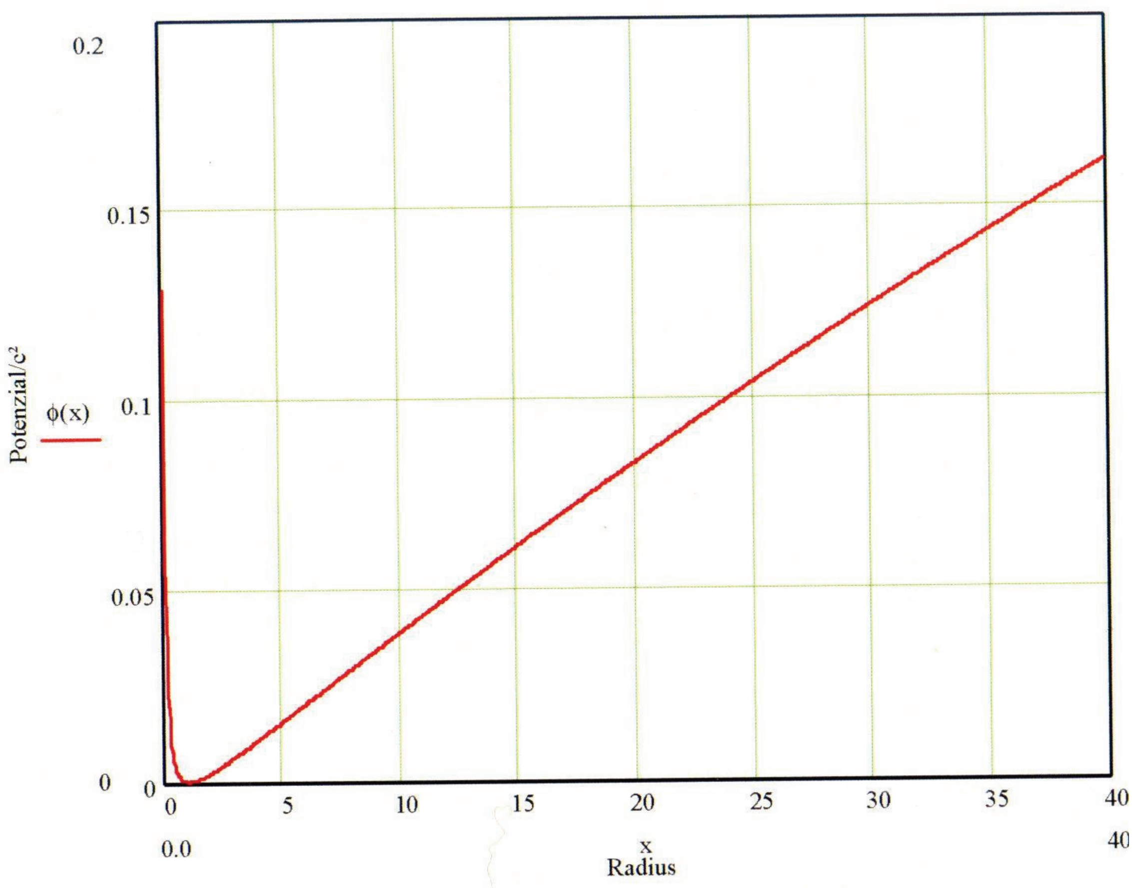

Illustration 5:

Fundamental process of the Heim Gravitationspotenzials in the case $\beta > 0$