About one model of gravitation interaction

Abstract

This article examines the gravitation interaction of a trial body and massive body of a finite size. It uses the notion of “gravitons”, which are believed to be the smallest sub-elementary particle with weak interaction with substance ("a graviton hypothesis"). The cumulative effect of gravitons on a trial body manifests in "jogging" one body to another. This approach explains the mechanism of observable "gravitation" of one body to another without involving the theory of relativity or the concept of space curvature. The article shows formulas devised using this approach, and the calculation of gravity force using these formulas completely corresponds to Newton’s law of gravity (which was devised empirically).

Model

Let's place a trial body "A" (test-mass) in the center of sphere, through which in the random directions flies a very small and light sub-elementary particle (Fig.1). Let's name this sub-elementary particle "graviton". Let's also assume that gravitons have an extremely high penetrability and weak interaction with matter, i.e. they give up a very small part of their momentum to particles of matter.

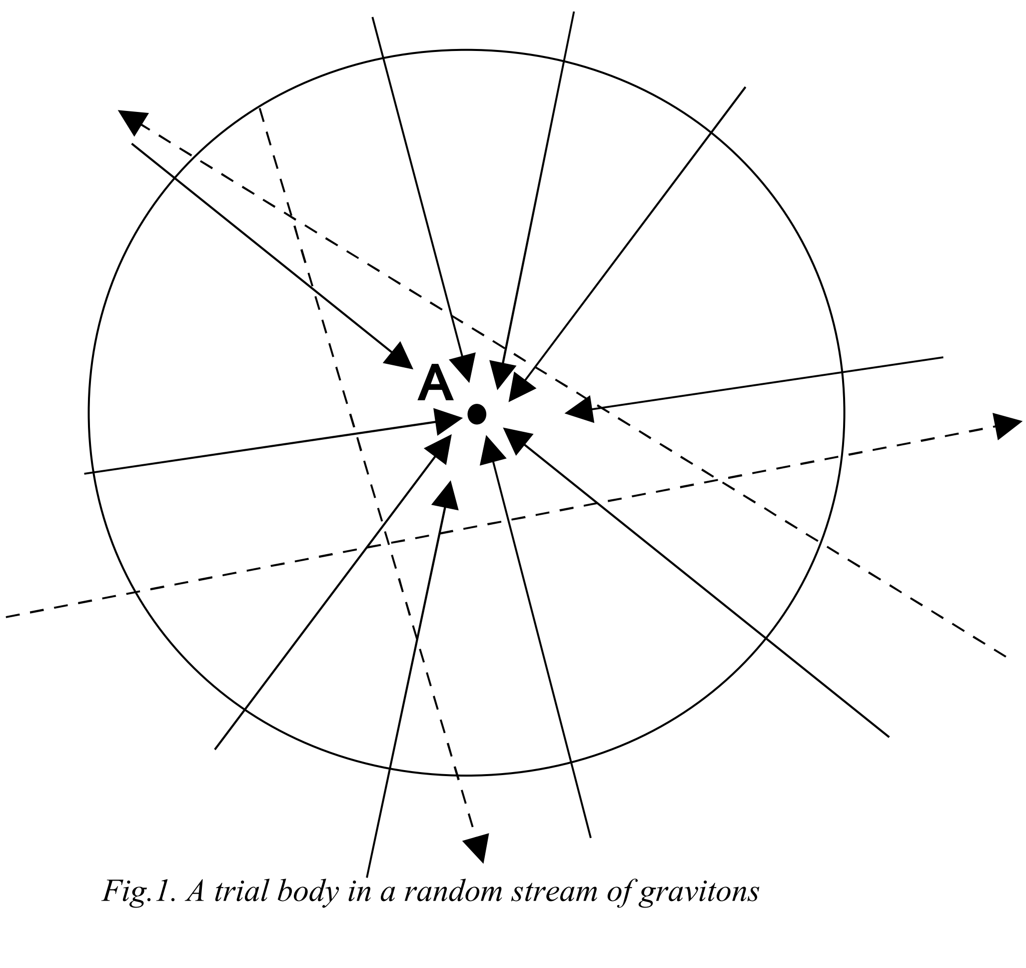


Fig.1. A trial body in a random stream of gravitons

The gravitons are evenly distributed in space. The majority of them will fly past a trial body "A". The dotted lines in Fig. 1 mark their paths.

Those gravitons which hit the trial body, will give up a part of their momentum. The density of the graviton stream through sphere is constant.

Because all gravitons are identical, the vector of the total momentum which they exhort on the trial body will be zero. Therefore, the trial body will be at rest.

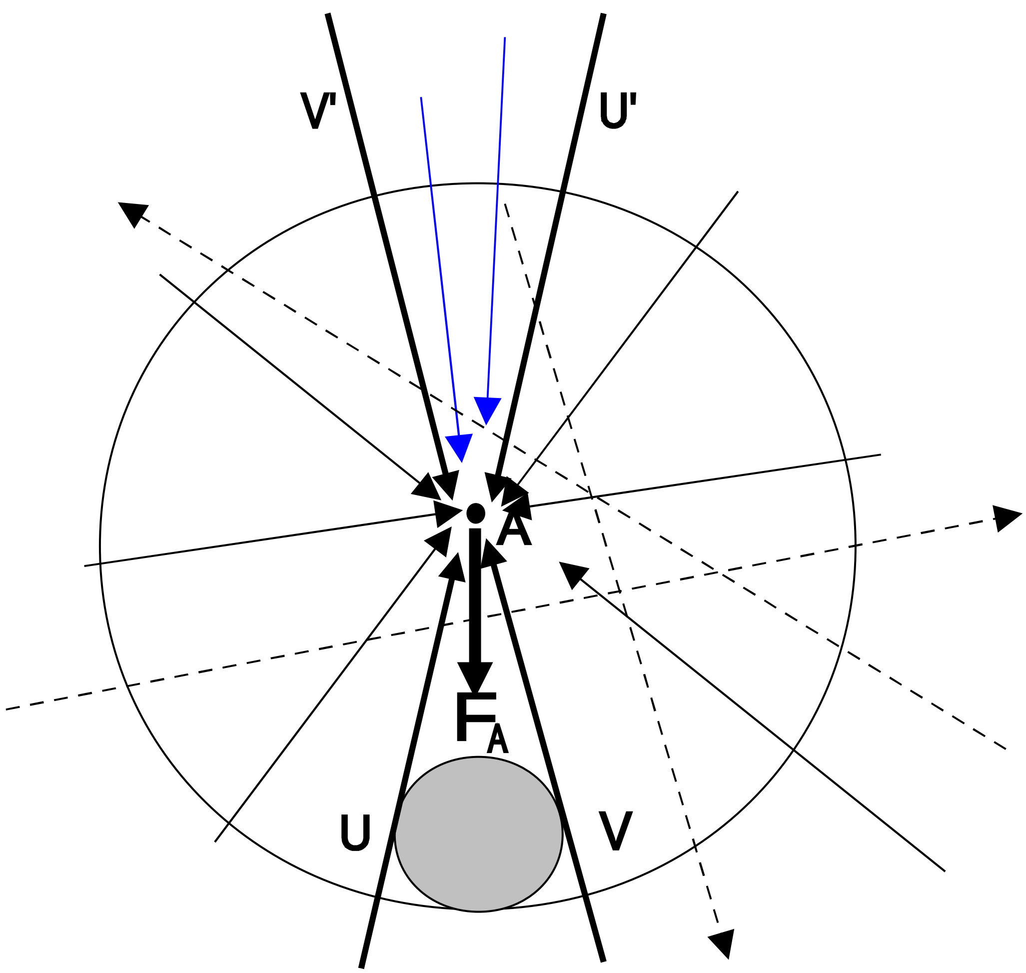


Fig.2. The screening of a graviton stream by a mass body.

Let's place the mass spherical body at some distance from the trial body “A” (Fig.2). It is obvious that, if the gravitons are absorbed partially by that full-sphere, it screens the trial body from the effect of gravitons coming from the space angle UAV. Meanwhile, the gravitons arriving from a space angle U’AV’ push the trial body with unchanged intensity. The resulting effect of all gravitons on a trial body will not be equal to zero. The force F_A will be directed precisely to the center of the spherical body.

The magnitude of the force acting on a trial body will depend on the quantity of gravitons absorbed by the mass body.

This force is directly proportional to magnitude of a space angle UAV, which is, in turn, is proportional to square of distance.

This model exhibits not the "attraction" but the "pushing" of to bodies toward each other. But, if the observer knows nothing about "gravitons", and only sees the interaction of the bodies, the result will appear as the attraction of one body to another.

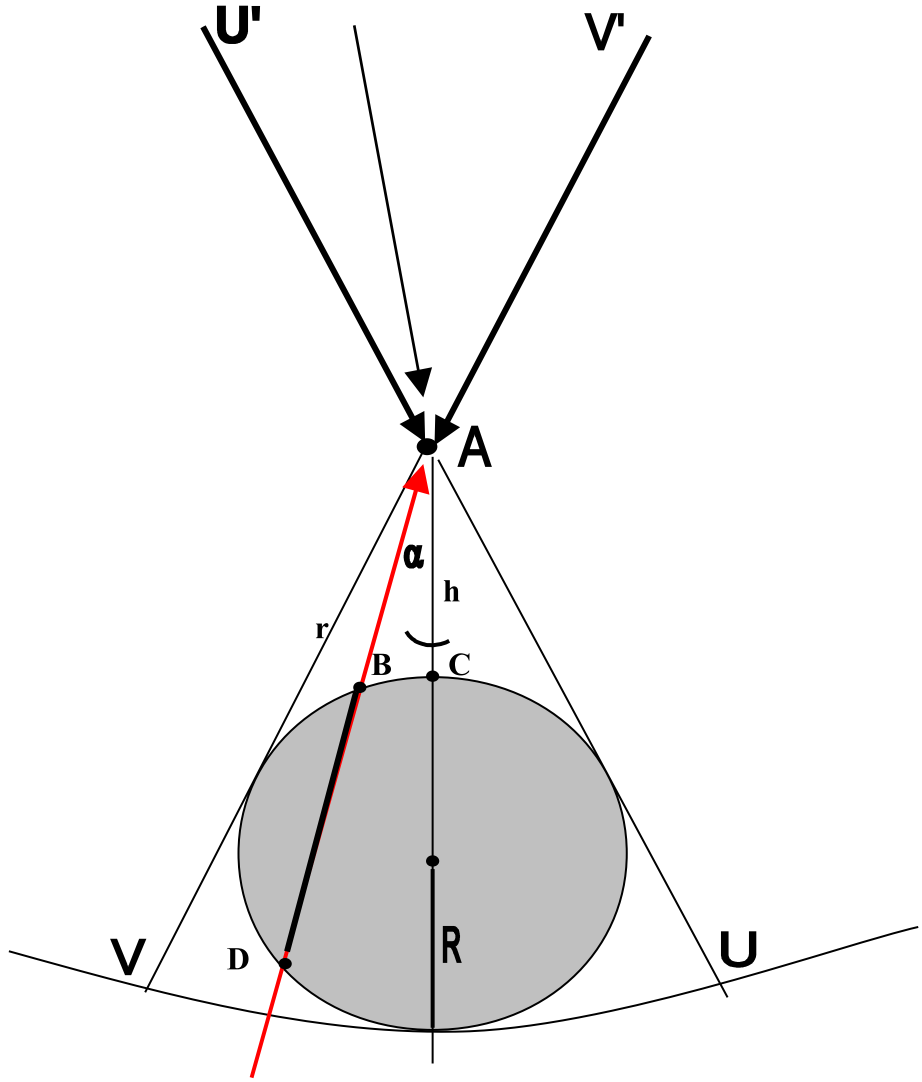


Fig.3.The weakening of a graviton stream by a separate section of a mass body

An effect of the gravitons on a trial body is equal to the difference of two graviton streams. One of the streams comes to a trial body "A" from space angle UAV, derived from the mass body which has absorbed the gravitons. The gravitons are absorbed on any section (horde) BD of this body (Fig.3). The second stream comes to a trial body "A" from the same space angle U'AV ' from the opposite direction.

The Appendix shows the formula for the pushing force at any given distance, as related to the force acting on distance of two radiuses from the center of the spherical body:

$$\overline{F_A}(k) = \frac{\int_0^{\alpha_{\max}(k)} \left(\int_0^{b(k,\alpha)} \delta \cdot db \right) \sin 2\alpha \cdot d\alpha}{\int_0^{\alpha_{\max}(2)} \left(\int_0^{b(2,\alpha)} \delta \cdot db \right) \sin 2\alpha \cdot d\alpha} \qquad (1)$$

Where

$k = 1 + \frac{h}{R}$;

α - angle BAC (Fig.3);

$\alpha_{\max}$ - the greatest possible value of an angle α;

h - the distance of a trial body from a surface of an absorbing spherical body;

R - radius of an the absorbing body;

k=2 - for a case of a position of a trial body at a distance from a spherical body equal to the sphere radius;

b - length of a horde BD on Fig.3;

δ - density of an absorbing body at any point.

Generally, an absorbing spherical body can vary in density along the radius (Fig.4). It is known that the Earth has a more dense kernel whose diameter is about half of Earth's diameter. This calculation is also applicable for that case.

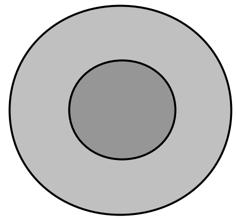


Fig.4. A mass body with a variable density on radius

The numerical integration of the formula (1) leads to the result completely corresponding to the results or the calculation by the classical formula of Newton's law of gravity.

The calculations have shown that the resulting force on a trial body will be same for any distribution of density on radius if the density is function of distance to the center only.

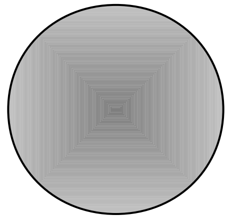
Verification of model adequacy

Does the model described here correspond to reality? This could be best examined during a total solar ecplipse.

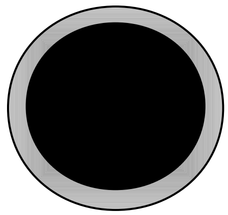
The gravity constant of the earth's surface is effected by the sun and the moon. According to Newton's theory, during a solar eclipse, the force of gravity of the moon and the sun are summed together so the weight of a body on earth's surface should decrease.

But according to the proposed model, it should be exactly the opposite. Gravitons can be fully absorbed in a large enough mass of a star (the Sun). Such a result is demonstrated in fig. 5.

For the sake of clarity, let's assume that the Sun totally absorbs gravitons in almost all of its diameter.



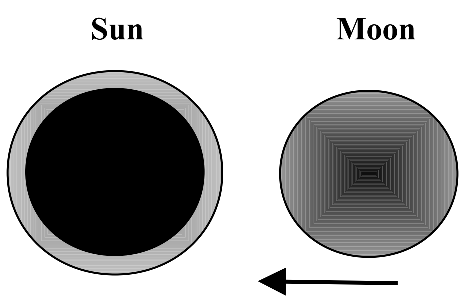
A) The shadow of a planet with an incomplete absorbtion of gravitons



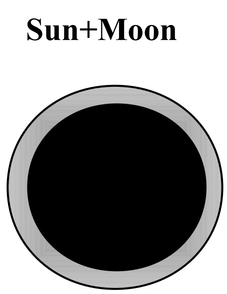
B) The shadow of a star with total absorption of gravitons

Fig. 5 The shadow of objects with partial and full absorbtion of gravitons.

While the Sun and the Moon are located in different places of the skyscape, each of them absorbs its own share of gravitons. But during a solar eclipse the situation changes (Fig.6)



a) Location of the Sun and the Moon before anlipse



b) Location of the Sun and the Moon during an eclipse

Fig.6 Eclipse

The moon enters into a total «gravity shadow» of the sun. Before the eclipse, the Moon just slightly reduced the flow of gravitons. However, during the eclipse, the moon can no longer weaken the flow because it is already absorbed by the Sun entirely.
For an observer on earth's surface the Moon would seem to disappear from the sky. Therefore, the weight of a body on earth's surface should decrease.

Conclusions

The notion of an unknown force causing bodies to attract to each other, has allowed Newton to find only empirical formula of the law of universal gravity. That formula, according to Newton, is true for any distances.

The theory of the "pushing" of bodies to each other by gravitons explains the phenomenon physically and consistently. The formulas obtained here exactly coincidence with result of account under the empirical formula of the law of gravity.

The theory above helps understanding the cause of gravitational interaction between bodies. It explains the reason of the planets' rotation around the Sun, planets' warm-up, the processes occurring inside planets and stars. It allows to specify the reasons of star evolution and, possibly, to understand the reason of formation and development of our universe, and to derive a source of power allowing to it to exist generally.

Acknowledgements:

Yekaterina Dainson, for editing the text
Gregory Vilshanshky, for finding and correcting mistakes

Appendix

Effect of a gravitons on a trial body

A gravitons are fly in a direction of a trial body "A" from different directions (Fig1).
An angular density of a graviton stream ($n = const$) is amount gravitons, flying by through unit of a space angle for a time unit.
.

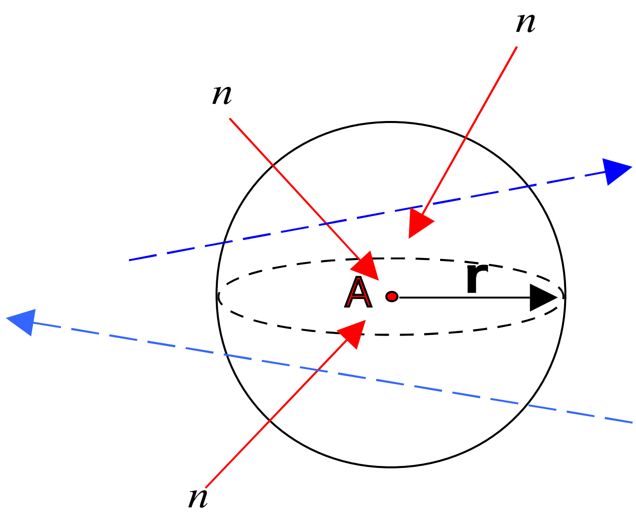


Fig.1 Effect of a gravitons on a trial body

A gravitons effect ("press") on a trial body "A" from different directions, therefore their total effect is equal to zero.

Let's arrange on some distance r from a trial body the shield with the center in a point O (Fig.2).. On this shield we shall allocate a surfent of area of the small area dS . Let thickness of a surfent of area is equal b , and surfent of area is located under some corner α to an axes OA.

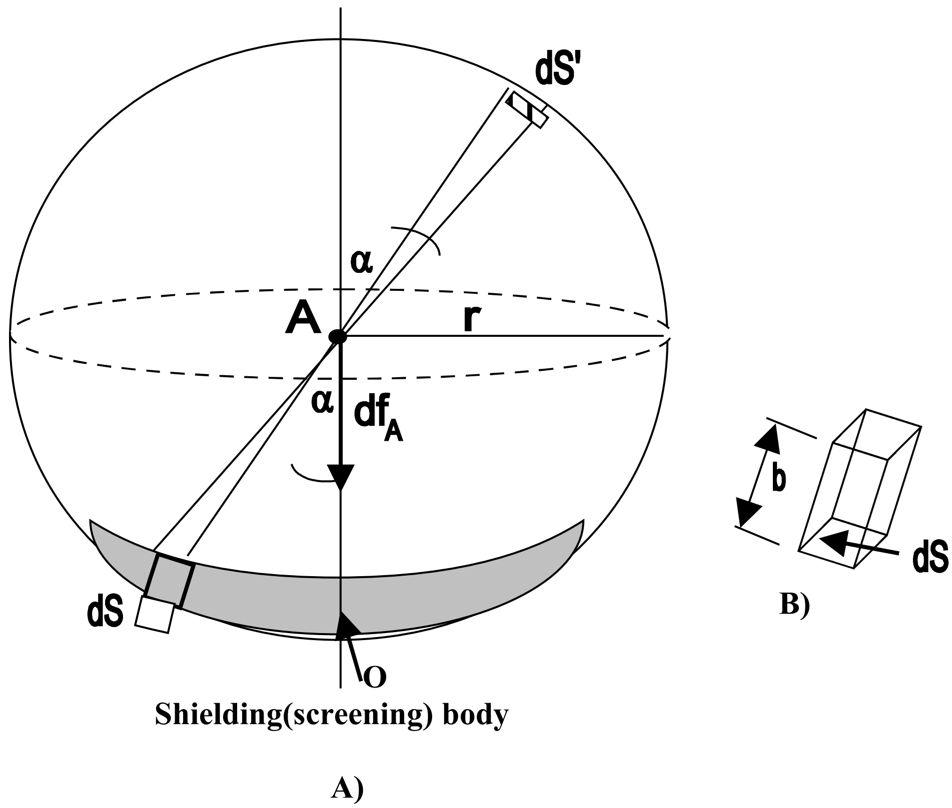


Fig.2 Effect of a gravitons, transiting through a surfent of area with a different absorption factor dS and dS'.

À) Streams through surfent of area dS and dS'
B) Chosen volume of an absorptions which is appropriate to a surfent of area dS (is located from below)

Let's enter concept "an absorption factor of the shield" δ
δ - share transiting through the shield a gravitons, which is absorbed by the shield of unit volume (unit area and unit thickness).
$0 \le \delta \le 1$

At $\delta = 1$ - there is a complete absorption of a gravitons by the shield of unit thickness
At $\delta = 0$ - shield is completely pervious for a gravitons.

Generally magnitude δ variable along thickness of a surfent of area.

Case below will be considered, when the shield not completely absorbs flying by through it a gravitons. (The case of a complete absorption will be considered in separate paper).

Let on a surfent of area dS gets n_s a gravitons, and

$$n_s = \frac{n}{r^2} dS$$

The part of a gravitons is absorbed by the shield. Let's designate this magnitude as dn_s

$$dn_s = n_s \int_0^b \delta \cdot db = \left(\frac{n}{r^2} \int_0^b \delta \cdot db \right) dS$$

Thus, through the shield will fly by $n_s - dn_s$ gravitons.
Effecting on a trial body, these gravitons will establish in a direction of an axes OA a force

$$a(n_s - dn_s)\cos\alpha,$$

where a - constant of proportionality.

Let's locate a surfent of area dS' diametrically opposite to a surfent of area. dS on same distance r from a trial body. If the surfent of area. dS' does not contain the shield, through it flies n_s gravitons. The projection of force of their pressure to a direction OA is equal

$$an_s \cos\alpha$$

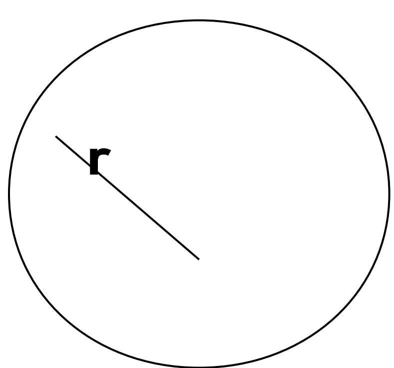
and it is directional to the opposite party.

It is obvious, that the resulting force of effect on the part of two these opposite streams is equal

$$df_A = a\cos\alpha \cdot dn_s$$

This force is directional to the shield from a point "A" along an axes OA (Fig.3)
Generally, if the shield has the area S and is located on distance r from a trial body "A", the total force will be determined by a ratio

$$F_A(r) = \int_S df_A = \frac{an}{r^2} \int_S \left(\int_0^b \delta \cdot db \right) \cos\alpha \cdot dS \qquad (1)$$



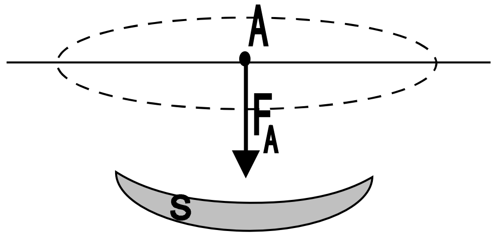


Fig.3. A force effecting a trial body

Absorption of a gravitons by a body of the spherical shape

Let's consider the shield as a full-sphere of radius R. The trial body "A" is located on distance *h* from its surface (Fig.4).

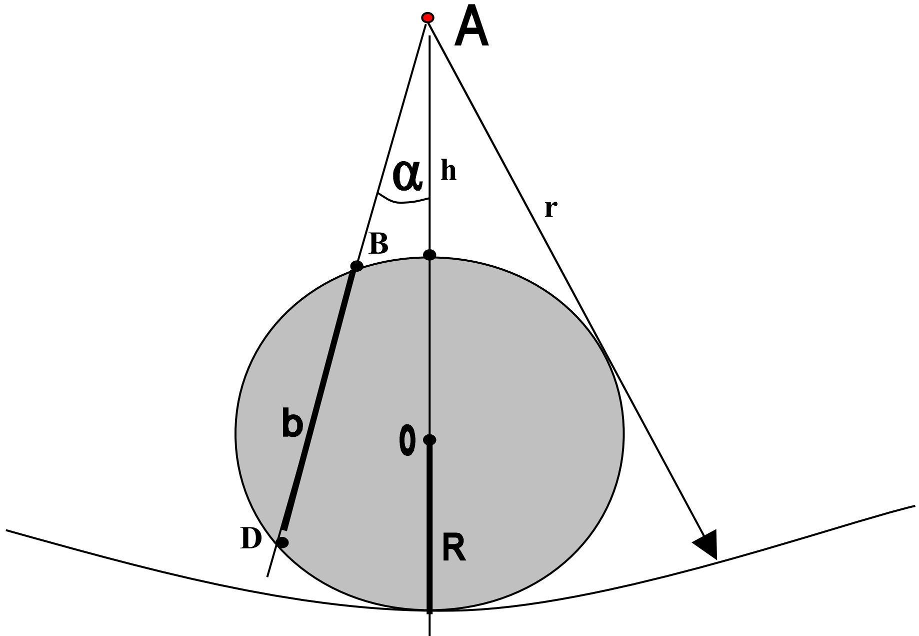
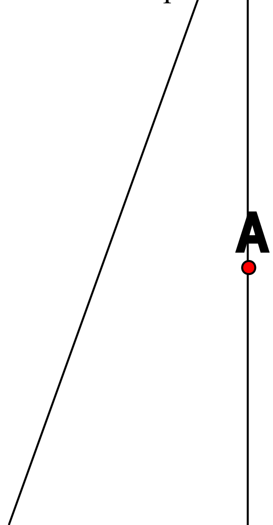


Fig.4. To account of a graviton absorption by a body of the spherical shape

Let's assume, that the distribution of a density of a full-sphere (and, hence, an absorption factor δ) depends only on distance up to the center of a full-sphere.



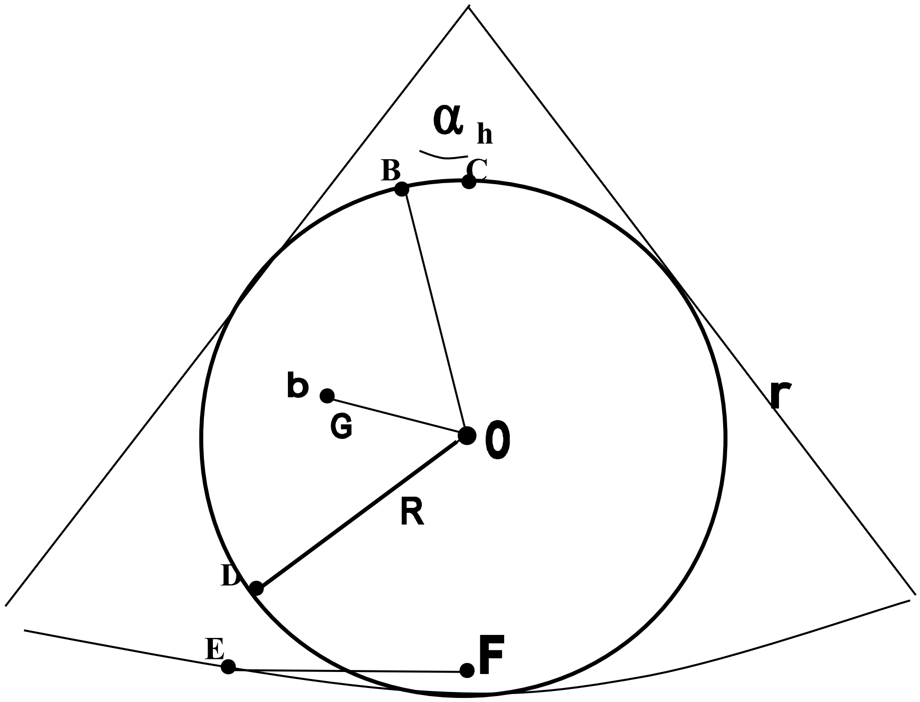


Fig.5. To a conclusion of the formula for effecting force on a trial body

Let ã gravitons fly to a trial body "A" along some straight line EA. Then the thickness of a shielding stratum in this direction is equal $b = BD$.

From geometrical reasons

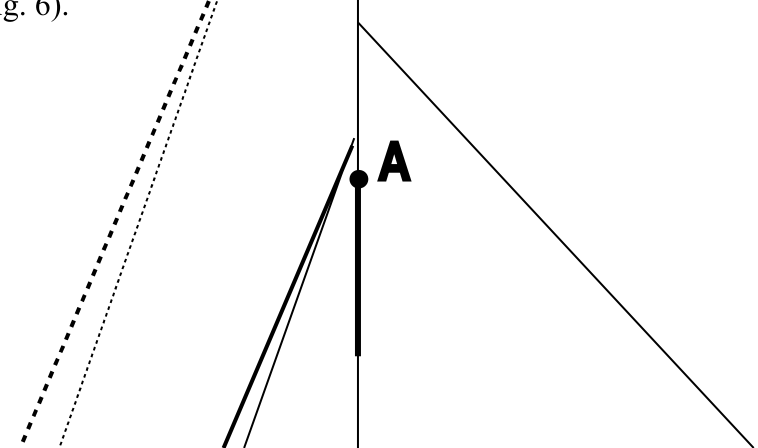
$$b = 2R\sqrt{R^2 - (R+h)^2 \sin^2 \alpha}$$

Let's designate $k = 1 + \frac{h}{R}$

Thus

$$b(k,a) = 2R\sqrt{1 - k^2 \sin^2 \alpha} \qquad (2)$$

In a case, when the shielding body has symmetric concerning an axes OA the shape, it is possible to consider a surfent of area dS as a globe stratum of radius *r*, formed by an angle $d\alpha$ (Fig. 6).



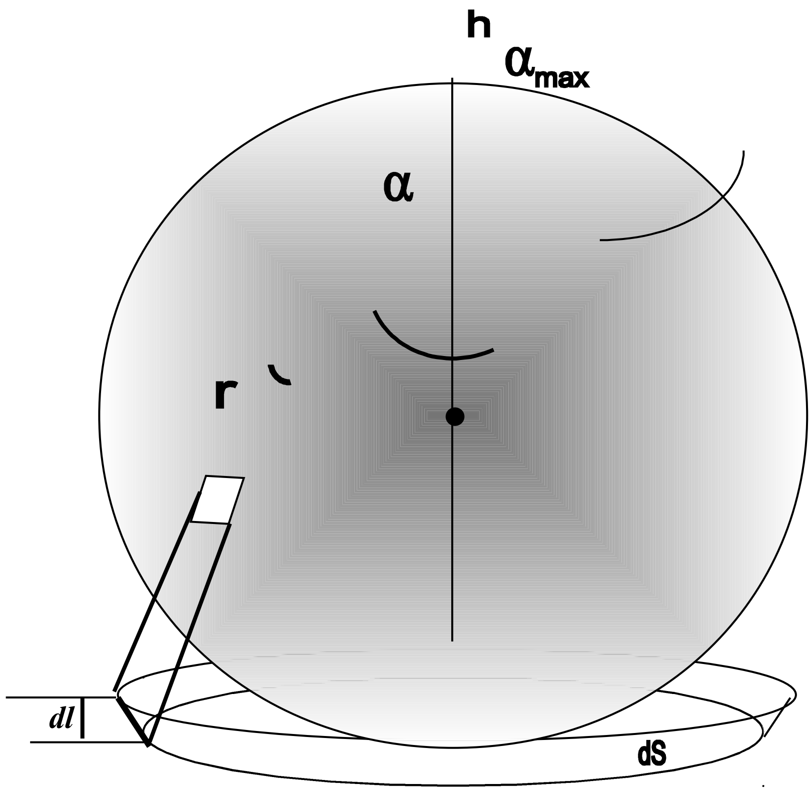


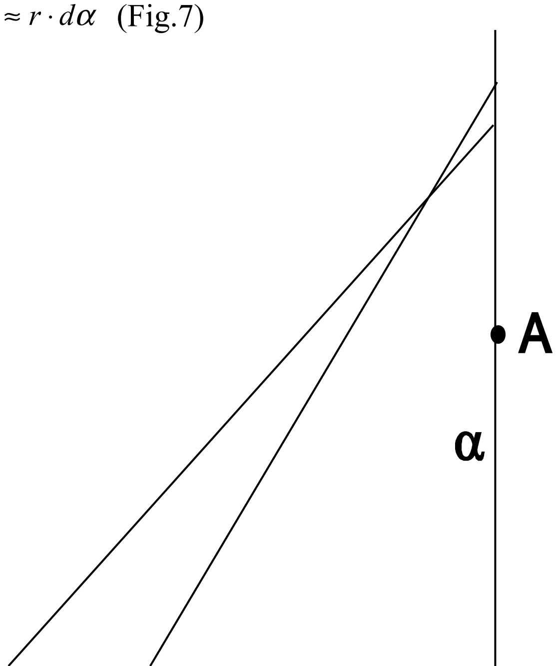
Fig.6. A surfent of area as a focus globe stratum.

The square of a globe stratum is determined by a ratio

$$dS = 2\pi \cdot r \cdot dl$$

where *dl* - height of a globe stratum.

In turn $dl \approx r \cdot d\alpha$ (Fig.7)



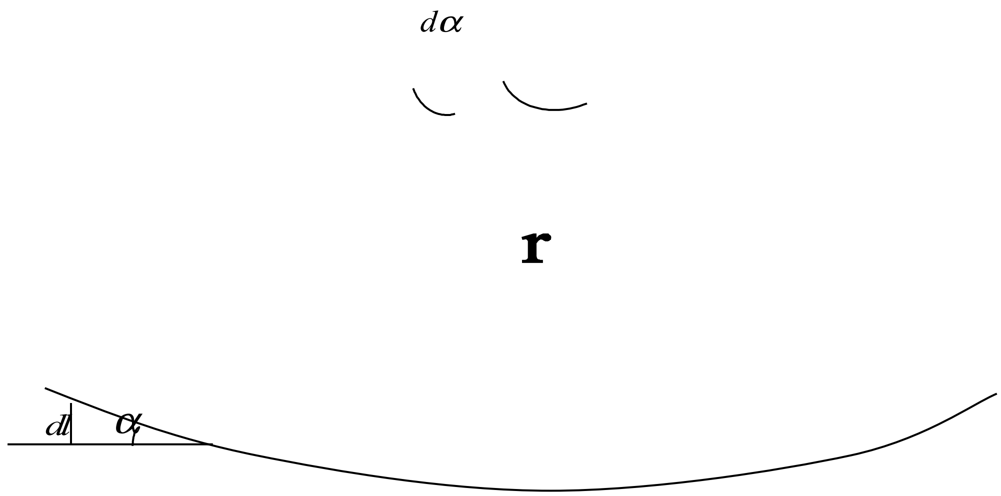


Fig.7. Height of a globe stratum

Then

$$dS = 2\pi r^2 \sin\alpha \cdot d\alpha \qquad (3)$$

Substituting (3) in (1) we shall determine the force F_A for the shield formed by a spherical body

$$F_A(k) = \pi n a \int_0^{\alpha_{\max}(k)} \left(\int_0^{b(k,\alpha)} \delta \cdot db \right) \sin 2\alpha \cdot d\alpha \qquad (4)$$

where

b - is determined from (2)

$\alpha_{\max}(k)$ - an angle between an axes AO and tangent to a surface of a spherical body (at Fig.6).

From geometrical reasons

$$\alpha_{\max}(k) = \arcsin \frac{1}{k} \qquad (5)$$

To not depend on magnitudes *a* and *n*, we shall consider(examine) "relative" force $\overline{F_A(k)}$, determined as

$$\overline{F_A}(k) = \frac{F_A(k)}{F_A(2)} \qquad (6)$$

That is as the relation of force effecting on a trial body on any distance *k* from a shielding full-sphere, to force effecting on a trial body, is located on distance *h*=*R* from its surface (*k*=2).

Then

$$\overline{F_A}(k) = \frac{\int\limits_0^{\alpha_{\max}(k)} \left(\int\limits_0^{b(k,\alpha)} \delta \cdot db \right) \sin 2\alpha \cdot d\alpha}{\int\limits_0^{\alpha_{\max}(2)} \left(\int\limits_0^{b(2,\alpha)} \delta \cdot db \right) \sin 2\alpha \cdot d\alpha} \qquad (7)$$

For a case, when a density of a spherical shielding body is magnitude fixed ($\delta = const$) with the account (2) we have

$$\int\limits_0^b \delta \cdot db = b\delta = 2R\delta\sqrt{1 - k^2 \sin^2 \alpha}$$

Hence (7) will be converted in

$$\overline{F_A}(k) = \frac{\int\limits_0^{\alpha_{\max}(k)} \sqrt{1 - k^2 \sin^2 \alpha} \cdot \sin 2\alpha \cdot d\alpha}{\int\limits_0^{\alpha_{\max}(2)} \sqrt{1 - 4\sin^2 \alpha} \cdot \sin 2\alpha \cdot d\alpha} \qquad (8)$$