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Shielding the Gravitational Field in Space

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ABSTRACT

The study presents a model for screening gravitational waves. fields of protons of the cosmos. Gravity shielding is based on a principle. An elementary particle with a rest mass. In free fall. Shields the gravitational fields in which it is located. In the above work the intensity of the gravitational field from the infinite cosmic field is determined half-spaces. The cross section of the proton shielding the gravitational field is determined. The radius of action of gravitational forces in space is calculated. The formula is obtained, which determines the distance to the galaxy by its " red " shift. Time calculated the life of a photon in space. The size of the visibility horizon of the universe is determined.

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Basic Part

Calculate the strength of the gravitational field from the infinite space half-space. Let the density of matter in space be n protons in volume unit. A material point with mass m is located at the beginning of a spherical point coordinate systems (Fig. 1). The half-space is bounded by the XY plane and is infinite along the Z-axis.

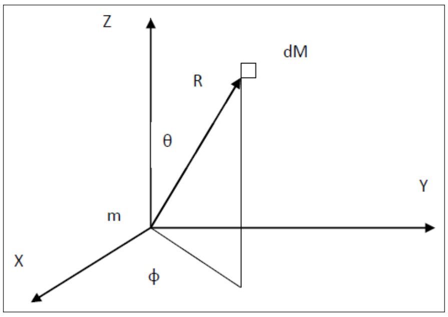

Figure 1

The volume element of this half-space in the spherical coordinate system $dV=R^2 \sin\theta d\theta\ d\varphi dR$ The mass in this volume dM=pdV where p is the average density of the substance space (n-protons per unit volume). The mass dM acts on the mass located in the the origin of a point with mass m with force $dF=\frac{\gamma m\ dM}{R^2}$

The force component along the Z axis is equal to $dF=\frac{\gamma m\ dM}{R^2}\cos\theta$ or $dF=\gamma m\rho \cos\theta \sin\theta\ d\theta d\varphi dR$. The force acting on the mass m from the side of the half-space is equal to $F=\gamma m\rho \int\sin\theta \cos\theta\ d\theta d\varphi dR$ denote $J=\int\sin\theta \cos\theta\ d\theta \int d\varphi \int dR$ where $0\leq\theta\leq\pi/2$; $0\leq\varphi\leq2\pi$; $0\leq R<\infty$; $\pi=3.14$

To eliminate the divergence of the integral. We apply the shielding action of particles space on the gravitational field. The force exerted by the element dM on the mass m. It will be weakened by the particles of the cosmos located inside the solid angle dω. Under which the volume element dV is visible from the origin.

The area dS for which based on the solid angle dω is equal to $dS=R^2 \sin\theta\ d\theta d\varphi$ Volume of the solid angle cone equal to $dV=\frac{1}{3}R\ dS$ The number of particles in this volume is equal to

$dN=\frac{1}{3}\ nR\ dS$ or $dN=nR^3\ \frac{1}{3}\sin\theta\ d\theta d\varphi$. The area overlapped by the protons of the cosmos inside the solid angle dω is equal to $dS_0=\sigma\ dN$ where σ is the cross section of the proton completely shielding the gravitational field. Replace dN with its expression. We get $dS_0=\frac{1}{3}\sigma nR^3 \sin\theta\ d\theta d\varphi$. We introduce the screening

coefficient $k=\frac{dS_0}{dS}$ or $k=\frac{1}{3}n\sigma R$ By k=1 we get $R_0=\frac{3}{n\sigma}$ At a distance of R=R0, the particle m will be completely shielded from protons located at a distance greater than R0 . We write the integral in the form $J=\int\sin\theta \cos\theta\ d\theta \int d\varphi \int kdR$ where $0\leq\theta\leq\pi/2$; $0\leq\varphi\leq2\pi$;

$0\leq R\leq R0$ We get $J=\frac{\pi}{6}n\sigma R^2$ The force acting on the particle m from the side of the half-space is equal to $F=\frac{3}{2}\frac{\pi\gamma m\rho}{n\sigma}$ If we express the density ρ in terms of the mass of the proton Mp, we get

$\rho = n\ Mp$. Then $F=\frac{3}{2}\frac{\pi\gamma m\ Mp}{\sigma}$ The strength of the gravitational field from the half-space $g=\frac{F}{m}$

$$g=\frac{3}{2}\,\frac{\pi\gamma\,Mp}{\sigma} \qquad (1)$$

Let's calculate the energy loss of a photon as it propagates in outer space. Let us assume that at time t =0 the radiation source A emitted a photon with a frequency v direction AB (Fig. 2). Divide by the plane containing the segment AB all outer space is divided into two half-spaces. Left and right. Mentally we will destroy all the cosmic matter in the left half-space. Let's introduce a rectangular the coordinate system. The Z-axis is perpendicular to the plane containing the segment AB . X-axis directed along the segment AB. Under the action of the attraction of the substance of the right half-spaces. The path of the photon deviates from the straight line AB towards the right half-spaces. The photon will receive an impulse along the positive direction of the Z-axis . The matter of the right half-space will also start moving towards the photon trajectory. If there is a substance in the left half-space. Then the path of the photon will be a straight line line AB. The substance in the volume of the cylinder of radius R_0 will start moving towards the trajectory photon. The energy of the photon will be spent on setting the matter in motion space to the path of the photon. Kinetic energy acquired by the matter of the cosmos. Will be equal to the loss of photon energy. The frequency of the photon will decrease. Calculate reduction of the photon energy in the section of its trajectory with length L . Let us assume that at the moment of the photon emission t=0, its energy was ε=hν . After a time Δt, the photon energy will be $\varepsilon^1=h\nu^1$. Consider the transverse motion of a photon along the Z-axis Under the influence of the attraction of the right half-space of the space filled with matter. At the end of its trajectory at point B, the photon acquires a transverse velocity V directed along the Z axis . For the transverse motion of a photon, the dependence of its mass on the velocity of its transverse motion is

$$m^1=\frac{m}{\sqrt{1-\frac{V^2}{c^2}}}$$

where m is the mass of the photon at the moment of its emission; m^1 is the mass of the photon after time Δt after the moment of its emission; c is the speed of light in a vacuum. At the end of the trajectory at the point B the photon energy increases by

$$\Delta\varepsilon=\frac{mc^2}{\sqrt{1-\frac{V^2}{c^2}}}-mc^2$$

The transverse velocity of the photon V at point B is determined from the equation

$$V=gt=g\,\frac{L}{c}$$

where g is the strength of the gravitational field from the right half-space. If everyone the space is filled with matter, then the photon energy decreases in the area the trajectory AB=L will be equal to 2Δε

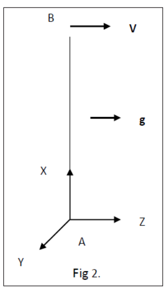

Figure 2

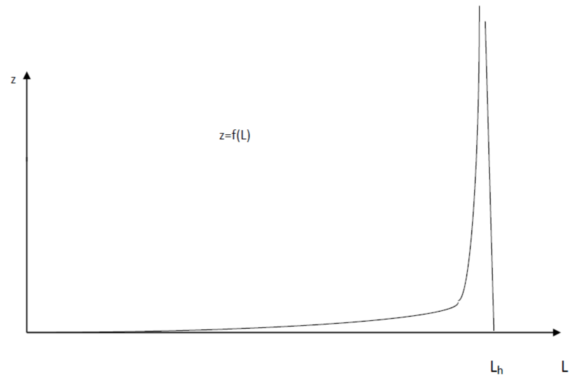

Figure 3

$$h\nu-h\nu^1=2h\nu\left(\frac{1}{\sqrt{1-\frac{V^2}{c^2}}}-1\right)$$ From here

$$\frac{V}{c}=\frac{\sqrt{1+\frac{\Delta\nu}{4\nu}}}{1+\frac{\Delta\nu}{2\nu}}\sqrt{\frac{\Delta\nu}{\nu}} \qquad (2)$$

We use the " red " shift of the radiation spectra from distant galaxies $z=\frac{\lambda^1-\lambda}{\lambda}$ where λ - the wavelength of the emitted photon; λ^1 - the wavelength the observed photon. Then $z=\frac{\nu}{\nu^1}-1$ from here $\frac{\Delta\nu}{\nu}=\frac{z}{z+1}$ Let us substitute in formula (2) the expression for $\frac{\Delta\nu}{\nu}$ we get

$$\frac{V}{c}=\frac{\sqrt{z(5z+4)}}{3z+2}$$

Substitute $V=g\,\frac{L}{c}$ we get $\frac{3}{2}\,\frac{\pi\gamma\rho L}{n\sigma c^2}=\frac{\sqrt{z(5z+4)}}{3z+2}$

Substituting p = nMp we get $$\sigma=\frac{3}{2}\,\frac{\pi\gamma L M_p}{c^2}\,\frac{(3z+2)}{\sqrt{z(5z+4)}} \qquad (3)$$

From astronomical observations, we take the value of the" red " shift z and distance to the galaxy L. Then, using the formula (3) , we can find the cross section of the proton a fully shielded gravitational field. For the values z =0.005 and $L=0.493\cdot10^{24}$ m . We get $\sigma = 0.4\times10^{-28}$ m^2. Diameter of the shielding cross-section the gravitational field of the proton is equal to $d=7.2\times10^{-15}$ m. Imagine z as a function of L . Let's introduce the notation

$\alpha=\frac{3}{2}\,\frac{\pi\gamma M_p}{\sigma c^2}$ From formula (3) a quadratic equation is obtained

$(9\alpha^2L^2-5)z^2+(12\alpha^2L^2-4)z+4\alpha^2L^2=0$ From the condition z=0 for L=0, the quadratic equation has a single root

$$z=\frac{2(1-3\alpha^2L^2-\sqrt{1-\alpha^2L^2})}{9\alpha^2L^2-5} \qquad (4)$$

From (4) it follows $0\le\alpha^2L^2\le1$ The denominator is zero for $\alpha^2L^2=\frac{5}{9}$

Hence $L = \frac{\sqrt{5}}{3\alpha}$ is the break point for the function z=z(L).

The limits to the left and right of the break point z have the values + -∞ . Substitute α in the expression $L = \frac{\sqrt{5}}{3\alpha}$ We get the visibility horizon of the Universe L= 0.5·10^{25}м.

Knowing the" red " shift of the galaxy. You can calculate the distance to this galaxy according to the formula

$$L = \frac{2}{3}\frac{\sigma c^2}{\pi\gamma M_p}\frac{\sqrt{z(5z+4)}}{3z+2} \qquad (5)$$

Photon lifetime in space $T_p = \frac{2}{9}\frac{\sigma c\sqrt{5}}{\pi\gamma M_p}$ (6)

The horizon of visibility of the universe $L_h = \frac{2}{9}\frac{\sigma c^2\sqrt{5}}{\pi\gamma M_p}$ (7)

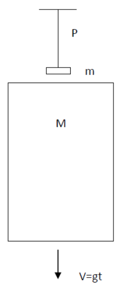

Figure 4

Conclusion

The shielding of the gravitational field can be detected experimentally on the installation (Fig. 4). Let M be a lead cylinder, P be high-precision scales, m is the mass suspended on the scale. At the moment of the beginning of the fall of the cylinder M the scale P should reduce the reading.