ANALYSIS OF PODKLETNOV’S PHENOMENON BASED ON EXPANSIVE NONDECELERATIVE UNIVERSE

Miroslav Súkeník and Jozef Šima
Slovak Technical University, FCHPT, Radlinského 9, 812 37 Bratislava, Slovakia
e-mail: sukenik@minv.sk, sima@chtf.stuba.sk

Abstract

Owing to Vaidya metric including, the model of Expansive Non-decelerative Universe (ENU) is able to localize gravitational energy. Based on the quantification of gravitational field of the Earth, ENU allows to rationalize and quantify the effects of a superconductor-based high voltage impulse gravity generator constructed by Podkletnov. The differences in energy effect observed for two generators used are explained and improvement of the experiment arrangement is proposed.

Keywords: Podkletnov’s phenomenon; impulse gravity generator; Expansive Nondecelerative Universe; gravity localization; solar corona temperature

1 Introduction

In the recent papers [1-3], the detection of anomalous forces formed within electron discharge from a superconductive ceramic emitter to a targeting electrode has been described. It has been hypothesized that these forces are of gravitational nature. The whole time of a discharge was $10^{-5}$ to $10^{-4}$ s, the peak value of the current at the discharge was of the order $10^4$ A, the voltage varied in the range of 500 kV to 2 MV. The distance between the electrodes was 15 cm to 2 m. Based on the total charge localized on the emitter ($\sim 0.1$ C) the discharge energy approached $10^5$ J. The gravity impulse accompanying the discharge propagated as a coherent beam in the same
direction as the discharge and penetrated through different media (air, brick wall, steel plate) without any noticeable loss of energy. It acted on mobile objects such as spherical 10 to 50 g weighing pendulums made from different materials (rubber, glass, metal, plastics) hanging on a cotton thread like a repulsive force independent on the pendulum material and proportional to their mass. Measurements of the impulse taken at the distance of 3 m, 6 m and 150 m gave identical results.

The experiment was theoretically rationalized by Modanese [3] who stated that the phenomenon could not be understood in the framework of general relativity. He proposed an explanation combining a quantum gravity approach and anomalous vacuum fluctuations.

In this contribution, an independent rationalization of the physical nature of the Podkletnov's experiments, explanation of different efficiency reached using two generators, and proposals for improvement of the efficiency are offered stemming from the background of the model of Expansive Nondecelerative Universe [4-8].

2 Background of the model of Expansive Non-decelerative Universe

The basic principles of the Expansive Nondecelerative Universe model were presented in a series of papers [4-8]. The model differs from more frequently used models of inflationary universe in the following features:

a) Schwarzschild metric is replaced by Vaidya metric,
b) the Universe permanently expands by the velocity of light \( c \),
c) simultaneous creation of matter and the equivalent amount of gravitational energy (which is, however, negative and thus the total value of mass-energy is constant and equal zero) occurs,
d) the Einstein cosmological constant and the curvature index are of zero value.

Statement b) can be expressed as follows

\[
a = c.t_c = \frac{2G.m_U}{c^2}
\]  

(1)

where \( a \) is the gauge factor, \( t_c \) is the cosmological time, \( m_U \) is the Universe mass (their present values are \( a \cong 1.3 \times 10^{26} \text{ m} \), \( m_U \cong 8.6 \times 10^{52} \text{ kg} \), \( t_c \cong 1.4 \times 10^{10} \text{ yr} \)).

In the ENU the state function is formulated as

\[
p = -\frac{\varepsilon}{3}
\]  

(2)
i.e. a trace of the energy-momentum tensor equals to zero.

In Vaidya metric [9, 10] the line element is formulated in the form

\[ ds^2 = \frac{\Psi'^2}{f(m)} \left( 1 - \frac{2\Psi}{r} \right) c^2 dt^2 - \left( 1 - \frac{2\Psi}{r} \right)^{-1} dr^2 - r^2 \left( d\theta^2 + \sin^2 \theta d\varphi^2 \right) \quad (3) \]

where

\[ \Psi = \frac{G.m}{c^2} \quad (4) \]

\( m \) is the mass of a body, \( f(m) \) is an arbitrary function. In order to \( f(m) \) be of nonzero value, it must hold

\[ f(m) = \Psi \left[ \frac{d}{dr} \left( 1 - \frac{2\Psi}{r} \right) \right] = \frac{2\Psi^2}{r^2} \quad (5) \]

As rationalized in [11] in the ENU

\[ \Psi' = \frac{d\Psi}{c.dt} = \frac{\Psi}{a} \quad (6) \]

Vaidya metric may be applied in all cases for which the gravitational energy is localizable, i.e. if

\[ r \leq r_{ef} \quad (7) \]

where \( r_{ef} \) is the effective gravitational range of a body with the gravitational radius \( 2\Psi \).

\[ r_{ef} = (r_g.a)^{1/2} = (2\Psi.a)^{1/2} \quad (8) \]

Gravitational influence can be thus realized only when the absolute value of gravitational energy density will exceed the critical energy density.

The energy-momentum complex of Einstein pseudotensor is [12]

\[ \theta_i^k = \frac{1}{16\pi} \left[ \frac{g_{lm}}{\sqrt{-g}} \left\{ -g(g^{kn}.g^{lm} - g^{km}.g^{ln}) \right\}_{;m} \right]_{;n} \quad (9) \]

Application of Vaidya metric in Cartesian Kerr-Schild coordinates was solved by Virbhadra [10] who calculated the components of Einstein pseudotensor in a general form. In our approach, instead of a generally formulated \( \Psi' \) its actual expression (6) is offered. The complete pseudotensor components are published elsewhere [11], in case of weak fields, its main component

\[ \theta_0^0 = -\frac{c^4}{8\pi G r^2} \Psi' \quad (10) \]
represents the gravitational energy density in the first approximation. Relation (10) may be understood as being identical to Tolman equation
\[ \varepsilon_g = -\frac{R_c}{8\pi G} \] (11)
where \( R \) is the scalar curvature. In Schwarzschild metric, \( R = 0 \), \( i.e. \) gravitational energy is not localizable outside a body since \( \varepsilon_g = 0 \) there. In Vaidya metric
\[ R = \frac{6G}{\tau^2c^3}\frac{dm}{dt} = \frac{6Gm}{t_c\tau^2c^3} = \frac{3r_g}{a.r^2} \] (12)
where \( R \) is the scalar curvature in the distance for a body having the mass \( m \). It follows from (9), (10) and (11) that the density of the gravitational field energy generated by a body with the mass \( m \) at the distance \( r \) is
\[ \varepsilon_g \approx -\frac{3m.c^2}{4\pi.a.r^2} \] (13)

Within the limits of ENU model it is thus possible to localize and determine \( \varepsilon_g \).

Substituting the Earth mass and its radius into (13), the energy density value of the Earth gravitational field is then
\[ |\varepsilon_g(\text{Earth})| \approx 25 \text{J.m}^{-3} \] (14)

Stemming from (11), gravitational output \( P_g \) is
\[ P_g = -\frac{d}{dt} \int \frac{R_c}{8\pi G} dV = -\frac{m.c^3}{a} = -\frac{m.c^2}{t_c} \] (15)

The energy density of the gravitational field can be expressed also as
\[ \varepsilon_g = \frac{E_g}{\lambda_C} \] (16)
where \( E_g \) and \( \lambda_C \) are the energy of a gravitational field quantum and its Compton wavelength
\[ \lambda_C = \frac{\hbar}{m.c} = \frac{\hbar.c}{E_g} \] (17)

For the energy of a gravitational field quantum it then hold
\[ E_g = \left( \varepsilon_g.\hbar^3.c^3 \right)^{1/4} \] (18)
Due to its wave nature, gravitational field may be described by a wave-function $\Psi_g$

$$\Psi_g = \exp(i.\omega.t)$$  \hspace{1cm} (19)

and using (18) and (19)

$$\omega = \left(\frac{m.c^5}{a.r^2.\hbar}\right)^{1/4}$$  \hspace{1cm} (20)

Based on Schrödinger-like equation for the gravitational waves

$$E_g.\Psi_g = i.\hbar \frac{d\Psi_g}{dt}$$  \hspace{1cm} (21)

the energy of a quantum of gravitational field induced by a body with the mass $m$ at the distance $r$ is given as

$$E_g = -\left(\frac{m.\hbar^3.c^5}{a.r^2}\right)^{1/4}$$  \hspace{1cm} (22)

Substituting the values for the Earth into (22) it follows

$$|E_g| \approx 10^{-19} \text{J}$$  \hspace{1cm} (23)

3 Interpretation of the Podkletnov’s results stemming from the ENU

Within the Podkletnov’s experiments [1-3], electrostatic field with the mean voltage intensity

$$E \approx 2.5 x 10^6 \text{V/m}$$  \hspace{1cm} (24)

was applied which corresponds to the mean energy density

$$\varepsilon_E \approx 27 \text{J/m}^3$$  \hspace{1cm} (25)

Comparing this value with that given by (14) it is obvious that

$$\varepsilon_E \approx |\varepsilon_g(\text{Earth})|$$  \hspace{1cm} (26)

Our explanation of the Podkletnov’s phenomenon lies in a hypothesis that the Earth gravitational field interferes with the electrostatic field created within a discharge. The gravitational attractive force of the Earth
results from the attraction of a body (pendulum) by the whole Earth. Provided that it is the only force exerting on a body, its direction is vertical as a result of the vector sum of attractive forces exerted by all the Earth parts. Should the Earth gravitational field be attenuated in a certain location (direction) the other attractive forces prevail. The observed deflection of pendulum thus results from „non-vertical“ Earth attraction. The pendulum deflection is, therefore, not a consequence of a repulsive force created within a discharge but lies in a local attractive force decreasing due to reducing the Earth gravitational field caused by its interference with electrostatic field.

In the mathematical language the above ideas can be expressed as follows.

The energy density of the electrostatic field is defined as

\[ \varepsilon_E = \frac{\varepsilon_0 V^2}{2 r_x^2} \]  \hspace{1cm} (27)

where \( V \) is the applied voltage and \( r_x \) is the distance between electrodes. Based on (13), (14), (26), and (27) for the conditions on the Earth surface it then follows that

\[ V^2 \approx \frac{3 m_{(Earth)} c^2 r_x^2}{2 \pi \varepsilon_0 r_x^2_{(Earth)}.a} \]  \hspace{1cm} (28)

It is obvious that the optimal distance between the electrodes is

\[ r_x \approx 0.2 \text{m} \]  \hspace{1cm} (29)

for the applied voltage of \( V = 500 \text{ kV} \), and

\[ r_x \approx 0.85 \text{m} \]  \hspace{1cm} (30)

for \( V = 2 \text{ MV} \).

A theoretical treatment of (28) leads to a conclusion that to discharge only one electron from the emitter at the voltage of \( V \approx 1 \text{ V} \), it should hold

\[ r_x \approx 10^{-7} \text{m} \]  \hspace{1cm} (31)

Such an electron would obtain the energy of 1 electronvolt, i.e.

\[ E_{(e)} \approx 1.6 \times 10^{-19} \text{J} \]  \hspace{1cm} (32)

which is close to the energy of a gravitational quantum at the Earth surface (23). It can be, therefore, supposed that in cases when the requirement (26) is fulfilled, each discharged electron creates one quantum of the Earth gravitational field irrespective to the voltage applied. It directly followed
from ([18]) that the energy of a gravitational quantum depends on the energy
density only. At the Podkletnov’s experiment, the total charge localized on
the emitter at the voltage of 2 MV reached
\[
Q \approx 0.1 \text{C}
\] (33)
which corresponds to a number of electrons
\[
n(e) = \frac{Q}{e} \approx 10^{18}
\] (34)
Within a discharge at 2 MV, \(10^{18}\) quanta of gravitational field are formed,
each of them bearing the energy of about \(10^{-19}\) J.

Podkletnov observed [3] that the total energy of a deflection depended on
the pendulum mass. This observation is consistent with (4) and (8) stating
that the higher the mass, the higher the effective gravitational radius. It
must hold for the potential energy of a displaced pendulum
\[
\Delta E = m(P) n(e) |E_g|(kg^{-1})
\] (35)
where \(m(P)\) is the mass of pendulum. For \(m(P) = 18.5\) g (data in [3] are
related to this pendulum mass) relation (35) leads to
\[
\Delta E \approx 1.8 \times 10^{-3}\text{J}
\] (36)
which is in good accordance with the experimental data obtained using both
a newer equipment (emitter 2)
\[
\Delta E \approx 1.3 \times 10^{-3}\text{J}
\] (37)
and an older one (emitter 1), where
\[
\Delta E \approx 2.3 \times 10^{-3}\text{J}
\] (38)

Stemming from (30) and comparing the values in (37) and (38) it is ob-
vious that the actual distance between the electrodes in a newer equipment
(0.15 to 0.4 m) was far from the optimal distance 0.85 m. We believe that
the rearrangement of a discharge chamber so as to permit to reach a higher
distance between the electrodes will lead to a higher alteration in the pen-
dulum potential energy. In addition, to preserve a high level of coherency
when applying higher voltages, the space between two electrodes should be
localized in an external magnetic field having the intensity proportional to
\(r_x\).
Relation (35) can be obtained by an independent way too. A flow of the gravitational energy of the Earth, $\sigma_{\text{Earth}}$ through its surface unit (hereinafter, all data are related to the surface of one square meter) is

$$\sigma_{\text{Earth}} = \frac{P_{g(\text{Earth})}}{4\pi c T_{\text{Earth}}},$$  

(39)

where $P_{g(\text{Earth})}$ is the gravitational output of the Earth (15). Due to a close proximity of the emitter and the pendulum and owing to coherent nature of the pulses, it can be written

$$\sigma_{(P)} \approx n(e) |E_g| = \frac{|E_g| Q}{e}$$  

(40)

where $\sigma_{(P)}$ is the gravitational energy flow from Podkletnov equipment through a surface unit. In such a case it must hold for the energy of pendulum deflection

$$\frac{\Delta E}{U} = \frac{\sigma_{(P)}}{\sigma_{\text{Earth}}},$$  

(41)

where $U$ is the potential energy of the pendulum with the mass $m_{(P)}$

$$U = \frac{G m_{\text{Earth}} . m_{(P)}}{r_{\text{Earth}}},$$  

(42)

It follows from (39) to (42) that

$$\Delta E \approx \left(\frac{4\pi a G |E_g|}{e c^2}\right) . Q . m_{(P)}$$  

(43)

The expression in parentheses is a constant of the value close to $1 \text{ C}^{-1} \text{ m}^2 \text{ s}^{-2}$. This is why (43) can be rewritten in a simpler form (and expressed in the above unit) as

$$\Delta E \approx Q . m_{(P)}$$  

(44)

Based on (34) and (35), as well as on the close numerical values of $|E_g|$ and $e$, relations (44) and (35) become thus almost identical.

For a vertical deflection of the pendulum, $h$ it can be written

$$h \approx \frac{Q}{g}$$  

(45)

where $g$ is the Earth gravitational acceleration. Once again, it is obvious from (44) that the vertical deflection of the pendulum depends only on the total charge, i.e. on the voltage between the electrodes.
4 Prospectives of application of the Podkletnov’s phenomenon

The Podkletnov’s phenomenon seems to be in principle of qualitatively new nature. If theoretically and experimentally proved more deeply, it could form an advantageous standpoint to rationalize several open phenomena. In this part its connection to the problems of fire balls stability, the hydrogen atom stability, and solar corona temperature is briefly outlined (the treatment of the problems in more details will be published elsewhere).

a) Stability of fire-ball-like plasmatic bodies

Our calculations indicate that in a case of simultaneous shortening the time of discharge and increasing the external magnetic field intensity at the voltage exceeding 500 kV, a stable plasmatic body with the radius of about 10 - 30 cm, similar to a fire ball, might be formed. From the technical point of view such an experiment is realizable since the kinetic energy of an electron at $V \geq 500 \text{kV}$ is comparable to its rest energy. The success of the experiment is conditioned mainly by the type of superconductive emitter.

b) The hydrogen atom

The density of electromagnetic energy in the hydrogen atom is

$$\varepsilon(H) = \frac{e^2}{4\pi \varepsilon_0 r_H^2} \approx 10^{12} \text{J/m}^3$$  \hspace{1cm} (46)

Putting the hydrogen atom into the gravitational field with a higher energy density, it would transform to a neutron. It is surely not a coincidence that the surface of a neutron star with the mass approaching $10^{30} \text{kg}$ and radius of about 10 km (common parameters of neutron stars) is characterized by the gravitational energy density close to that given by (46) (cf. 13). Evaluating the issue from another angle, based on (13) and (46) it is possible to estimate the parameters of neutron stars.

c) Solar corona temperature

The magnetic field density of a pulse magnetic field with the intensity of about $H \simeq 7 \times 10^3 \text{ A/m}$ is identical to the absolute value of the Earth gravitational field density. If a pendulum was positioned in such a magnetic field, each pulse would cause a displacement of the pendulum. A mean intensity of the Sun magnetic field is about $10^2 \text{ A/m}$, at some processes of magnetic field changes, however, the magnetic field intensity rises up to $10^5 \text{ A/m}$. It is worth pointing out that at the intensity of about $4 \times 10^4 \text{ A/m}$ the magnetic field density is equal to the energy density of the Sun gravitational field. Interference of both the fields might, at certain circumstances, increase the kinetic energy of particles forming the solar corona by means...
of Podkletnov-like effect and rise its temperature up to the present value of $10^6$ K. The apparent uniformity of the solar corona temperature might be a consequence of periodicity of the magnetic effects.

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