Abstract

In previously work,1 this author developed a theory which shows the unknown relations between main parameters in a given field of science. Using this theory, the outcomes of the derived formulas to estimate some magnitudes of our Universe exposed both well-known and new unknown equations. That paper1 which should be considered part 1 of this series offers possibly valid relations between energy, volume, time, matter, distance. The offered research shows that there exists in the Universe ONLY one primary substance – ENERGY. Volume, matter, time, fields are forms of the energy and can be transformed one to other, such as the transformation in the famous formula \( E = mc^2 \).

In paper, part 2 of that series, the author shows that the parameters of space (volume, distance) and time have limits (maximal magnitudes). The time, volume (distance) contract (collapse) into a point under the specific density of the matter, energy, pressure, temperature, frequency, intensity of acceleration, electric, magnetic, fields. The maximal force, temperature is independent from other conditions.

The computed critical values are very importance for micro and macro worlds. When a particle (universe, body) approaches them, for an external observer their dimensions, energy and lifetime tend to zero, i.e. they seem to disappear (they delete into infinity). Because they depend on matter (energy), this means that matter (energy) and in the universe are limited.

Introduction

The Universe is everything that exists, including the stars, the planets, galaxies, matter and energy. The Universe is also filling time and intergalactic space. The term universe may be used also as the world, the cosmos, or nature.

Astronomers observe current and earlier stages in the development of the Universe. They can see at great distances. They suggest that the universe has always been ruled by the same physical laws. The Solar System is implanted in a galaxy. The most galaxies have the billions of stars. The Milky Way and other galaxies that exist outside it, are located as far as astronomical instruments can reach. Current cosmology studies of galaxies and their spectral lines. The universe is expanding and had a beginning. Telescope Hubble shows galaxies consisting of billions of stars.

In Part 1, author offers the relations between volume, time, matter, distance, and energy. The author shows the Universe has only one substance – ENERGY. Time, volume, matter, field’s evidence energy

\[
\begin{align*}
E &= mc^2 \\
E_0 &= \frac{1}{\beta} \sqrt{1 - \frac{E^2}{E_0^2}} \\
n_0 &= N_0 V_0 \\
\gamma &= \frac{\beta}{\sqrt{1 - \beta^2}} \\
\gamma_1 &= \frac{\beta_1}{\sqrt{1 - \beta_1^2}} \\
\gamma_0 &= \frac{\beta_0}{\sqrt{1 - \beta_0^2}} \ \text{and they can be changed one to other. Author gives the equations which allow calculating these transformations. In particularly the author get from his theory the famous formula } E = mc^2.
\end{align*}
\]

The author shows that the matter, energy, and fields have boundaries (maximal amount). Volume and time can collapse into points under the specific density of matter, energy, temperature, pressure, frequency, intensity of acceleration, magnetic, electric, fields. The maximal force and temperature are independent from other conditions.

Theory shows: Values of the matter, energy and fields have a boundary. Volume and time collapse in these bounds.

The author shows the magnitudes of the matter, energy and fields have maximal limits. The volume and time collapse under the specific density of the matter, energy, pressure, temperature, frequency, intensity of acceleration, magnetic, electric, fields.

The well-known numbers used in his expressions are next:

\[
\begin{align*}
E &= mc^2 \\
c &= 2.997925 \times 10^8 \text{ m/s} \\
e &= 1.60219 \times 10^{-19} \text{ C} \\
G &= 6.6743 \times 10^{-11} \text{ N m}^2 \text{kg}^{-2} \text{ s}^{-2} \\
\hbar &= 6.6261 \times 10^{-34} \text{ J s} \\
\mu &= 4 \pi \times 10^{-7} \text{ N m}^2 \text{kg}^{-1} \text{ s}^{-2} \\
\sigma &= 5.67032 \times 10^{-8} \text{ W m}^{-2} \text{K}^{-4} \\
k_b &= 1.38066 \times 10^{-23} \text{ J K}^{-1}.
\end{align*}
\]

The energy, field, temperature, etc., sec.; \( E_0 \) is time of outer observer in his outer space, sec; \( E \) is energy into the given volume, \( J; E_0 \) is maximal possible energy into the given volume (density of energy), \( J/V \) (volume, m³); \( l \) is length in given volume having given substance (matter, energy, field, temperature, etc.) and measured by outer observer, m; \( l_0 \) is length into outer space measured by the outer observer (length measured by outer observer), m; \( \gamma \) is contraction (coagulation, rolling, collapse) coefficient.

The equation (2) for \( E_0 = Mc^2 > 0, \ E_0 / E \leq 1 \) gives the limits of
values (maximal acceleration, pressure, frequency, temperature, mass and volume density, intensity if fields, event horizons, etc.) which depend from positive mass.

The following expressions (equations for decreasing the length, time from circumstances in the given volume) can be gotten from the connection (2). In this step, we use the equation \( E_0 = Mc^2 \) and the appropriate equations from part 1.1

Influence of pressure \( \text{N/m}^2 \): \[
\gamma = \left( 1 - \frac{p}{p_0} \right)^{1/2} = \left( 1 - \frac{M^2G^2}{c^2} p \right)^{1/2}, \quad \text{where } p_0 = \frac{c^6}{G^2 M^2}, \quad (3)
\]
where \( p \) is current pressure, \( \text{N/m}^2 \); \( p_0 \) is maximal possible pressure, \( \text{N/m}^2 \).

Influence of mass density (kg/\( m^3 \)) \[
\gamma = \left( 1 - \frac{\rho}{\rho_0} \right)^{1/2} = \left( 1 - \frac{M^2G^2}{c^2} \rho \right)^{1/2}, \quad \text{where } \rho_0 = \frac{c^6}{G^2 M^2}, \quad (4)
\]
where \( \rho \) is current mass density, kg/\( m^3 \); \( \rho_0 \) is maximal possible mass density, kg/\( m^3 \).

Influence of specific energy density (J/\( m^3 \)) for volume \( \nu = \text{const} \) \[
\gamma = \left( 1 - \frac{E_\nu}{E_{\nu,0}} \right)^{1/2} = \left( 1 - \frac{M^2G^2}{c^2} E_\nu \right)^{1/2}, \quad \text{where } E_{\nu,0} = \frac{c^6}{G^2 M^2}, \quad (5)
\]
where \( m \) is specific current energy density, J/\( m^3 \); \( E_{\nu,0} \) is maximal possible energy density, J/\( m^3 \).

Influence of temperature (using an additional relation \( E = \frac{3}{2} k_BT \)): \[
\gamma = \left( 1 - \frac{t}{t_0} \right)^{1/2} = \left( 1 - \frac{c^6}{G^2 M} t \right)^{1/2}, \quad \text{where } t_0 = \frac{c^6}{k_B M}, \quad (6)
\]
here \( t \) is temperature, \( ^\circ K \); \( t_0 \) is maximal possible temperature, \( ^\circ K \); \( k_B = 1.38066 \times 10^{-23} \) J/\( K \) is Boltzmann constant.

Influence of field frequency \[
\gamma = \left( 1 - \frac{\nu}{\nu_0} \right)^{1/2} = \left( 1 - \frac{G M}{c^2} \nu \right)^{1/2}, \quad \text{where } \nu_0 = \frac{1}{T} = \frac{c^3}{G M}, \quad (7)
\]
here \( \nu \) is field frequency, \( 1/s \); \( \nu_0 \) is maximal possible frequency, \( 1/s \); \( m \) is maximal possible pressure, kg/\( m^3 \).

Wave De-Broil (using the additional relation \( \nu_B = E/h \)) \[
\gamma = \left( 1 - \frac{\nu_{B,0}}{\nu_B} \right)^{1/2} = \left( 1 - \frac{h}{2 \nu_B^2} \right)^{1/2}, \quad \text{where } \nu_{B,0} = \frac{2c^2}{h}, \quad (8)
\]
where \( \nu_B \) is wave frequency, \( 1/s \); \( \nu_{B,0} \) is maximal possible wave frequency, \( 1/s \); \( h \) is Planck constant, \( Js \).

Influence of the electric intensity [N/C] \[
\gamma = \left( 1 - \frac{E_\nu}{E_{\nu,0}} \right)^{1/2} = \left( 1 - \frac{e_0 G^2 M^2}{2c^8} E_\nu \right)^{1/2}, \quad \text{where } E_{\nu,0} = \frac{c^6}{e_0 G^2 M^2}, \quad (9)
\]
here \( E_\nu \) is electric intensity [N/C] or volt/meter [V/m]; \( E_{\nu,0} \) is maximal electric intensity [N/C]; \( e_0 \) is electric constant, F/m.

Influence of the magnetic intensity [A/m] \[
\gamma = \left( 1 - \frac{H}{H_0} \right)^{1/2} = \left( 1 - \frac{\mu_0 G^2 M^2}{2c^8} H \right)^{1/2}, \quad \text{where } H_0 = \frac{2c^8}{\mu_0 G^2 M^2}, \quad (10)
\]
where \( H \) is magnetic intensity [A/m]; \( \mu_0 \) is maximal magnetic intensity [A/m]; \( \mu_0 \) is magnetic constant, H/m.

Influence of the acceleration field [m/s^2] \[
\gamma = \left( 1 - \frac{a}{a_0} \right)^{1/2} = \left( 1 - \frac{4MG^2}{c^4} \right)^{1/2}, \quad \text{where } a_0 = \frac{c^4}{4GM}, \quad (11)
\]
where \( a \) is acceleration, m/s^2; \( a_0 \) is maximal acceleration.

Influence of the distance from the center of the central point gravitation field, \( r_s < r \) \[
\gamma = \left( 1 - \frac{r_s}{r} \right)^{1/2} = \left( 1 - \frac{2GM}{c^2} \right)^{1/2}, \quad \text{where } r_s = \frac{2G}{c^2}, \quad (12)
\]
where \( r \) is distance from the center of the central gravitation field, m; \( r_s \) is radius of Schwarzschild, m.

Influence of the distance from the center of the central electric field, \( r_e < r \) \( (\text{for charges only}) \) \[
\gamma = \left( 1 - \frac{r_e}{r} \right)^{1/2} = \left( 1 - \frac{k_0 Q^2G}{c^6} \right)^{1/2}, \quad \text{where } r_e = \frac{k_0 Q^2G}{c^6}, \quad (13)
\]

Note: The maximal possible magnitudes are given an precision with numerical issue/multiplying (about \( 10^{31} \)). This value is found from testing/measuring or additional estimation. For example, the maximal possible mass density in expression (4) is \[
\rho_0 = \left( \frac{3}{32\pi} \right) \frac{c^6}{G^2 M^2}. \quad (14)
\]

Substitute the kinetic energy \( E = MV^2/2 \) (V is speed, m/s) in expression (2) we get the well-known expression of the Einstein special relativistic theory:

\[
\frac{V}{c} \leq \frac{T}{T_0} = \sqrt{1 - \frac{v^2}{c^2}}, \quad \frac{l}{l_0} = \sqrt{1 - \frac{v^2}{c^2}}, \quad (15)
\]
where \( V \) - speed of a moving body, m/s; \( l \) - time in a moving system, sec; \( l_0 \) - length in a moving system, m; \( T \) - time in stationary system, sec; \( T_0 \) - length in stationary system, m;

Note, the expressions (2) – (13) are major differently from the relativistic equations (15). Expressions (15) measure the length and time of the body in a moving system of coordinates. The expressions (2– (13) show how changing the state of the motionless body that body can roll the size and time into point.

The numerical values of these limits in equations (2) – (13) are following (accuracy about 4 digits):

\[
\rho_0 = \frac{c^6}{G^2 M^2} = 2.1962 \times 10^{30} \frac{1}{M^2}, \quad (16)
\]

\[
E_{\nu,0} = \frac{c^6}{e_0 G^2 M^2} = 2.1962 \times 10^{30} \frac{1}{M^2}, \quad (17)
\]

\[
v_0 = \frac{c^2}{G M} = 4.0022 \times 10^{15} \frac{1}{M}, \quad (18)
\]

\[
t_0 = \frac{c^6}{k_B M} = 6.309607 \times 10^{-9} \frac{K}{M}. \quad (19)
\]

\[
E_{\mu,0} = \frac{c^6}{\mu_0 G^2 M^2} = 3.2544 \times 10^{10} \frac{N}{V \cdot kg \cdot m}, \quad (20)
\]
Universe (Part 2 v2): Rolling of space and time into a point

The offered expression (2) – (13) are basically different from the relativistic equations (15). Equations (15) measure the length and time of a body in a moving system of coordinates. The equation (2) – (13) shows how we must change the conditions (pressure, density, temperature) of the motionless body or intensity/density of the magnetic, electric, gravitation/acceleration or centrifugal fields that body collapse (the time and size) in point for the outside observer. The critical state can continue indefinitely.

The critical value/limit may be high. But our abilities increase over time. We can study strong fields in the micro world. We can better recognize the macro/micro processes in the world. The find limits are others or absent for negative mass, negative energy. In this case we may obtain repel (negative) gravity, the faster-than-light speed, unlimited energy from vacuum point, exotic matter, and so on, which may help to develop the power spaceships for the interstellar travels, or to explain the inflation of the Universe. The computed critical values are of big importance for macro and micro worlds. When a particle (in universe or body) approaches them, for an external observer their energy, dimensions and lifetime tend to zero, i.e. they seem to disappear. They depend on matter (energy). This means that matter (energy) in the universe is limited (Figure 1).

**Acknowledgements**

None

**Conflict of interest**

Authors declare there is no conflict of interest.

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8. Faster-than-light.

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The calculated critical magnitudes are of great importance for micro and macro worlds. When a particle (body, universe) approaches them, for an external observer their dimensions, energy and lifetime tend to zero, i.e. they seem to disappear. They depend on matter (energy). This means that matter (energy) in the universe is limited (Figure 1).

**Discussion and conclusion**

In Part 1¹ author shows: in the University is only ONE substance – ENERGY. Only energy makes other known forms: time, space, matter, gravitation, magnetic, electric, nuclear fields. This result formed a new view of dark matter, dark energy, extension and acceleration of the Universe.²–³

Core result the Part 2 of this research is that each form or state of energy (density of matter, density of energy, frequency, temperature, density/intensity of the gravity, magnetic, electric, nuclear fields) have a LIMIT. When we are forthcoming this limit, the time, space (length, distance, volume) collapse (roll up) in point.

![Figure 1](image.png) This image of the Hubble Ultra-Deep Field shows a diverse range of galaxies, each consisting of billions of stars.

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