We can't solve problems by using the same kind of thinking we used when we created them.

Albert Einstein

WORLD – UNIVERSE MODEL
FUNDAMENTAL PARAMETERS AND UNITS

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ABSTRACT

World – Universe Model is based on the following primary assumptions:

1) The World is finite and is expanding inside the Universe with speed equal to the electrodynamic constant c. The Universe serves as an unlimited source of energy that continuously enters into the World from the boundary.

2) Medium of the World, consisting of protons, electrons, photons, neutrinos, and dark matter particles, is an active agent in all physical phenomena in the World. All elementary particles are fully characterized by their four-momentum.

3) The Model is based on Maxwell's equations for electromagnetism and gravitoelectromagnetism which have two measurable characteristics: energy density ρ and energy flux density I. All other notions are used for calculations of these two measurable characteristics.

4) Two Fundamental Parameters in various rational exponents define all macro and micro features of the World: Fine-structure constant α and dimensionless quantity Q. While α is constant, Q increases with time, and is in fact a measure of the Size and the Age of the World.

5) Three Fundamental Units define all physical dimensional parameters of the World: basic unit of momentum p_0, basic unit of energy density ρ_0, and basic unit of energy flux density I_0.

INTRODUCTION

In the celebrated paper "Trialogue on the number of fundamental constants" [1] Lev B. Okun gave the following definition to Fundamental Parameters and Units: *"There are two kinds of fundamental constants of Nature: dimensionless (like* $\alpha \cong 1/137$*) and dimensionful (c – velocity of light, ħ – quantum of action and angular momentum, and G – Newton's gravitational constant). To clarify the discussion I suggest to refer to the former as fundamental parameters and the latter as fundamental (or basic) units. It is necessary and sufficient to have three basic units in order to reproduce in an experimentally meaningful way the dimensions of all physical quantities. Theoretical equations describing the physical world deal with dimensional quantities and their solutions depend on dimensionless fundamental parameters. But experiments, from which these theories are extracted and by which they could be tested, involve measurements, i. e. comparisons with standard dimensionful scales. Without standard dimensionful units and hence without certain conventions physics is unthinkable.*

The three basic physical dimensions: length L*, time* T*, and mass* M *with corresponding metric units: cm, sec, gram, are usually associated with the name of C. F. Gauss. In spite of tremendous changes in physics, three basic dimensions are still necessary and sufficient to express the dimension of any physical quantity. The number three corresponds to the three basic entities (notions): space, time and matter. It does not depend on the number and nature of fundamental interactions. For instance, in a world without gravity it still would be three".*

The World – Universe Model is developed around two Fundamental Parameters in various rational exponents which define all macro and micro features of the World: Fine-structure constant α, and dimensionless quantity Q. While α is constant, Q increases with time, and is in fact a measure of the size and the age of the World [2].

In the review of the World – Universe Model [2] we proposed the following three Fundamental Units of the World:

- The radius of the World's Nucleus a ($a = 2\pi a_0$, a_0 – classical electron radius);
- The electrodynamic and gravitoelectrodynamic constant c, which is the speed of the World – Universe Front;
- The surface enthalpy of the World – Universe Front $\sigma_0 = \frac{hc}{a^3}$ (h – Planck constant).

All Fundamental Units were connected to the physical characteristics of the World's Nucleus – the Beginning of the World. Then all physical parameters of the World can be expressed in terms of these Fundamental Units a, c, and σ_0 and Fundamental Parameters α and Q:

$$H_0 = \frac{c}{a} \times Q^{-1}$$ Hubble parameter

$$A_t = \frac{a}{c} \times Q$$ Age of the World

$$R = a \times Q$$ Size of the World

$\rho_0 = \frac{\sigma_0}{a}$	Basic energy density
$\rho_{cr} = \frac{3\sigma_0}{a} \times Q^{-1}$	Critical energy density
$E_0 = \sigma_0 a^2$	Basic energy
$E_W = 4\pi\sigma_0 a^2 \times Q^2$	Energy of the World
$h = \frac{\sigma_0 a^3}{c}$	Planck constant
$G = \frac{c^4}{8\pi\sigma_0 a} \times Q^{-1}$	Gravitational parameter
$\frac{8\pi G}{c^4} = \frac{1}{\sigma_0 a} \times Q^{-1}$	Einstein's parameter

The objective of this work is to offer another set of three **measurable** Fundamental Units relevant to the essence of the World – Universe Model (WUM).

Overview of the World – Universe Model

The World consists of the Medium (protons, electrons, photons, neutrinos, and dark matter particles) and Macroobjects (Galaxy clusters, Galaxies, Star clusters, Extrasolar systems, etc.) made of these particles.

There is no empty space in frames of the Model. The Universe serves as an unlimited source of energy that continuously enters into the World from the boundary.

The Model is based on Maxwell's equations for the electromagnetism and gravitoelectromagnetism which contain a single constant – electrodynamic constant c; two parameters of the Medium – magnetic parameter μ_0 and gravitomagnetic parameter μ_g; and two measurable characteristics: energy density ρ and energy flux density I. All other notions are used for calculations of these two measurable characteristics.

In WUM we have paid close attention to energy density. Sometimes we used the notion of mass density to facilitate understanding of the Model and correlations of its results with the existent theories and models, but the two concepts were shown to be interchangeable. For all particles under consideration we used four-momentum $\left(\frac{E}{c}, \boldsymbol{p}\right)$ (E – particle energy), but the final result of the statistical analysis was energy density ρ.

WUM holds that there exist relations between all Q-dependent time varying parameters: Gravitational parameter, Fermi coupling parameter, Hubble's parameter, Size of the World, Age of the World, Critical energy density of the World, Temperature of the Microwave Background radiation, Axion mass, Neutrino mass, etc. [2, 3, 4].

FUNDAMENTAL UNITS

In accordance with WUM it is natural to introduce the following measurable Fundamental Units:

- The basic unit of momentum $p_0 = \frac{h}{a}$;
- The basic unit of energy density $\rho_0 = \frac{hc}{a^4}$;
- The basic unit of energy flux density $I_0 = \frac{hc^2}{a^4}$.

All physical dimensional parameters of the World can be expressed through these basic units:

$t_0 = \frac{a}{c} = (\frac{p_0\rho_0}{I_0^2})^{\frac{1}{3}}$	Basic unit of time
$H_0 = (\frac{p_0\rho_0}{I_0^2})^{-\frac{1}{3}} \times Q^{-1}$	Hubble parameter
$A_t = (\frac{p_0\rho_0}{I_0^2})^{\frac{1}{3}} \times Q$	Age of the World
$a = (\frac{p_0 I_0}{\rho_0^2})^{\frac{1}{3}}$	Size of the World's Nucleus at the Beginning
$R = (\frac{p_0 I_0}{\rho_0^2})^{\frac{1}{3}} \times Q$	Size of the World
$c = \frac{I_0}{\rho_0}$	Electrodynamic constant
$h = p_0(\frac{p_0 I_0}{\rho_0^2})^{\frac{1}{3}}$	Planck constant
$\sigma_0 = (p_0\rho_0 I_0)^{\frac{1}{3}}$	Surface enthalpy of the World – Universe Front
$\rho_{cr} = \rho_0 \times Q^{-1}$	Critical energy density
$E_0 = \frac{hc}{a} = \frac{p_0 I_0}{\rho_0}$	Basic energy
$E_W = 4\pi\frac{p_0 I_0}{\rho_0} \times Q^2$	Energy of the World
$G = \frac{1}{8\pi}(\frac{I_0}{\rho_0})^4(\frac{\rho_0}{p_0^2 I_0^2})^{\frac{1}{3}} \times Q^{-1}$	Gravitational parameter
$æ = \frac{8\pi G}{c^4} = (\frac{\rho_0}{p_0^2 I_0^2})^{\frac{1}{3}} \times Q^{-1}$	Einstein's parameter

In our Model we often use well-known physical parameters, keeping in mind that all of them can be expressed through measurable Fundamental Units of the World: p_0, ρ_0, and I_0 and Fundamental Parameters α and Q.

SUPREMACY OF MATTER

When forced to summarize the theory of relativity in one sentence: time and space and gravitation have no separate existence from matter.

Albert Einstein

FUNDAMENTAL UNITS

In our view, the World consists of a homogenous and isotropic Medium consisting of elementary particles. Macroobjects built from the same particles are located in the Medium. The Medium behaves quite similarly to an ideal liquid, and its properties can be described using familiar Maxwell's equations.

All elementary particles are fully characterized by their four-momentum $\left(\frac{E}{c}, \boldsymbol{p}\right)$. To describe the behavior of the Medium and to conduct statistical analysis of particles' ensembles we must introduce the first Fundamental Unit – the basic unit of momentum p_0.

In any homogeneous and isotropic cosmology including our Model, the Hubble's parameter H_0 and its inverse value, the Hubble age of the World A_t, and also the Hubble length defined as $R = \frac{c}{H_0}$, are absolute quantities. The Center-of-mass frame of the Hubble sphere can then be viewed as the preferred frame, and we can discuss movement of objects relative to that frame. Since Cosmic Microwave Background radiation (CMB) is an integral component of the Medium, analysis of CMB radiation allows us to measure speed of objects relative to the preferred frame.

The distribution of Matter in the World is not homogenous due to existence of various Macroobjects. These Macroobjects are moving with different speeds relative to the preferred frame. For example, the speeds of the Milky Way and the Sun relative to CMB rest frame were measured to be 552 and 397 km/s respectively.

To describe the distribution of Matter and its fluxes in the World we propose to utilize Maxwell's equations that're built on two measurable characteristics: energy density ρ and energy flux density I. Consequently, to characterize the physical behavior of the World we introduce two more Fundamental Units: the basic unit of energy density ρ_0 and the basic unit of energy flux density I_0.

CHARACTERISTICS OF THE MEDIUM

In the World – Universe Model, the impedance of the Medium equals to the Hubble's parameter for the whole World:

$$Z_W = \mu_W \times c = \frac{1}{R} \times c = H_0$$

It follows that measuring the value of Hubble's parameter anywhere in the World and taking its inverse value allows us to calculate the absolute age of the World. Elapsed time can be calculated through the difference in the absolute age of the World.

The second important characteristic of the Medium is the gravitomagnetic parameter:

$$\mu_W = \frac{1}{R}$$

Taking its inverse value allows us to calculate the absolute radius of the World.

The impedance and gravitomagnetic parameter of the Medium are principally different physical characteristics that are connected through the gravitoelectrodynamic constant c.

In the World – Universe Model, time and space are closely connected with the Medium's impedance and gravitomagnetic parameter. It follows that neither time nor space could be discussed in absence of the Medium. Matter, then, is primary to time and space.

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References

1. M. J. Duff, L. B. Okun, and G. Veneziano (2002), arXiv: physics/0110060 v3.

2. V. S. Netchitailo (2013), viXra: 1303.0077 v7.

3. V. S. Netchitailo (2013), viXra: 1312.0179 v2.

4. V. S. Netchitailo (2014), viXra: 1401.0187 v2.