The Journal of Cosmology

Journal of Cosmology, 2011, Vol 13.
JournalofCosmology.com, 2011

The Origins of Matter of the Universe

Yair Goldin-Halfon
Physical-Genesis.org

ABSTRACT

The creation of the universe is described as a continuous process that commenced in the absence of matter and literally from a single point of the 4D Euclidean Space, eternal and in nite. Ironically this way the very existence of the universe becomes the main manifestation of the principle of conservation of energy. Indeed, if physical space is intrinsically closed and immersed in the 4D Euclidean Space, then its asymptotic expansion can be inextricably linked with the spontaneous creation of primary forms of energy on a par with the accumulation of intangible-negative-gravitational-potential-energy. This theory allows for the determination(s) of the mass of the neutral particle X which plays the role of dark matter, the electromagnetic coupling constant, and the electron-proton mass ratio.

Keywords: dark matter, alternatives to inflation, cosmology with extra dimensions, theory of distributions, fundamental bispinor equations, baryon asymmetry.

I. UNIVERSE IMMERSED IN 4D

In a logic scheme *nothing* cannot be an element of physical reality. How the universe could have started to expand into *nothing* if is not a physical concept? The weird conceptual structure of the big bang theory together with the fact that is impossible to justify that all the matter of the universe compressed together could have started to disperse against self-gravity, are only two of the many reasons that made prominent cosmologists become very sceptical about the validity of that theory (Van Flandern 2002, Eastman 2010; Kumar Lal 2010). Alternative viewpoints have been propounded (Arp et al. 2,004), however none of them answers the fundamental question of cosmology: what is of the origin of the matter of the universe? Truth tables in propositional algebra show that a pair of ideas with concise mathematical representation can serve as the basis for a self-contained theory of the creation of the universe: the latter must be immersed in 4D and the fact that the gravitational potential energy is intrinsically negative must be reckoned with.

Making an analogy with the circumference and the spherical surface, every physicist can infer that all the points (x,y,z,w) of physical space would satisfy the quadratic equation,

$$x^2 + y^2 + z^2 + w^2 = R_u^2(t). \tag{1}$$

The universe is thus intrinsically closed, immersed in the 4D Euclidean Space (eternal and infinite), and the geometric origin of the universe does not belong to physical space; hence astronomers cannot point to where the universe began. Interesting attempts to describe the universe with 4 spatial dimensions have been made (Ponce de Leon, 2004), but the *Principle of Creation* has never been considered. The mathematical representation of this principle is very simple:

$$-G\frac{E_u/c^2 \times E_u/c^2}{R_u} + E_u = 0 \tag{2}$$

It reads: *if the universe could be totally disassembled against self-gravity, the entire energy content of all its constituting particles would have to be used for such purpose* . Since, $E_u = (c^4/G)R_u$, it is easy to verify that the radius of the universe reached its first meter when the content of primary energy - whose specific nature is discussed later - had already exceeded 225 times the mass energy of planet earth.

Consider some confetti glued on a spherical balloon, the confetti represents galaxies. When the balloon inflates, the confetti moves in the radial direction in 3D. In a similar manner, galaxies, or clusters of galaxies, (hereafter considered to be true inertial systems of reference) flow with the expansion of physical space solely in the radial direction in 4D. With the proper orientation of the coordinate system, two inertial galaxies can be imagined like two points of a circumference that expands on the (x,y) plane. The one dimensional subset of points of physical space would consist exclusively of the points belonging to such circumference. The other five planes: (x,z),(x,w),(w,z), (w,y) and (y,z), are not involved in the expression for the physical distance " s " between the two galaxies. Actually we are orienting the system of coordinates so that the coordinates z and w in eq.(1) could be zero. So we have,

$$s = R_u\theta, \tag{3}$$

where the angle θ is fixed and R_u is an increasing function of time. The angle itself has no physical meaning since it is formed by the intersection of two lines at the geometric origin of the universe. Note that the radius vector of the universe is perpendicular to the geodesic joining any two points in physical space. If you hold a pencil, the radius vector remains perpendicular to the pencil regardless of its orientation! Evidently, the greater the angle, the greater the separation of two inertial galaxies, and the more rapidly they move away from each other while the radius grows (Hubble's law). Moreover, by simple symmetry it readily follows that the proper time of all inertial systems must run at the same pace. A new study has found that quasars moving away at different velocities give off light pulses at the same rate without a hint of time dilation, (Gugluicci, 2006). Apparently basic results of special relativity - which relies on the existence of inertial systems moving along infinite straight lines in the 3D Euclidean space - are not valid in cosmic scale.

Because the geometry of the overall universe must be predetermined to accommodate the principle of creation, it is not possible to apply general relativity in this study. Nevertheless the fundamental Riemann's differential line element,

$$(ds)^2 = (dR_u)^2 - c^2 g_{tt}(dt)^2 = 0, \tag{4}$$

is essential to determine the dynamic behaviour of R_u. For this purpose two assumptions are made:

- The tangible-positive-energy of the universe (hereafter called merely energy) is permanently increasing. We would like to believe that the creation of energy will not exceed an asymptotic value denoted as M^*c^2. Hence the asymptotic radius of the universe would be GM^*/c^2
- The radius and all the derivatives of the radius vanish at t=0; the radius is zero for negative time. These considerations are necessary to have smooth continuity and to restrict in a drastic manner the candidates for the function g_{tt}.

The simplest possible solution for eq.(4) satisfying the foregoing restrictions yields

$$R_u = \frac{GM^*}{c^2} \exp\Big(-\frac{GM^*}{c^3 t}\Big) \qquad E_u = M^* c^2 \exp\Big(-\frac{GM^*}{c^3 t}\Big), \quad t \geq 0 \tag{5}$$

thus implying that

$$g_{tt} = (GM^*/c^3 t)^4 \exp(-2GM^*/c^3 t) \tag{6}$$

The asymptotic energy of the universe will be determined later, but in order to continue with this section let's write the result in advance:

$$M^* = 3.24 \times 10^{53} Kg. \qquad GM^*/c^2 = 25.3 \times 10^9 l.y.$$

therefore the greatest separation any two objects could ever reach would be $\pi \times GM^*/c^2$.

From eq.(5) it follows that the radius of the universe started to expand incredibly slowly. It reached Plank's length - which is trillions of times smaller that the classical electron radius - after hundreds of millions of years of expansion. Since no particles could fit in such a small volume, we have to assume that during the first stage of the evolution of the universe, a primeval 4D vector field (the nature of which we need not know) started to fill in the 4D hyper-volume, $(x^2 + y^2 + z^2 + w^2 \leq R_u^2)$. When the radius reached the critical length Λ_0, to be determined later, the 4D hyper-volume rapidly lost one dimension and the energy associated with the 4D vector field transformed into ordinary electromagnetic radiation. This specific event gave birth to our 3D universe immersed in 4D. Since the universe is intrinsically closed, those initial photons could not escape and became part of the CMB. Our 3D universe was born with great luminosity; the collective energy of those initial photons, as we shall see later, exceeded the mass-energy of planet earth many millions of times.

II. PHILOSOPHICAL IMPLICATIONS, THE ACCELERATING UNIVERSE, THE COSMOLOGICAL RED SHIFT

It seems as though the universe started its existence out of the emptiness of space, but that is not the case: since cause and effect rule reality, we must assume that real 4D phenomena beyond our 3D physical perception triggered the beginning of the creation process. Principles need no justification, but there is no reason not to try to relate the principle of creation with the *first cause* which cannot be associated with any aspect of our physical reality. The fundamental constants, $\hbar, c, G$, and the eXon's mass M_x, as we shall see later, are all involved in the determination of the asymptotic energy of the universe that appears in eqs. (5) describing the evolution of the universe from the very first instant of physical time. Therefore we believe the fundamental constants where determined before physical time started to run by God who allowed for the principle of conservation of energy to materialize. Science will never be able to explain the intrinsic value of the speed of light for our fundamental units of length and time involve " c " . We may ask, under what criterion was " c " determined? The question itself is merely a remainder whom shall we render reverence to. Are we saying something new? Only in part; thousands of years ago ancient peoples stopped worshipping celestial bodies to embrace the concept of God as the creator of the universe. The other aspect of the religious perspective, the one that relates God with the fate of men, is the individual's prerogative and science has no say in that regard. The new part, anyway, is that we are applying mathematics to represent this very old and quite natural philosophical viewpoint.

In contra-distinction with our vision of physical genesis, the advocates of the big bang theory believe that a primeval concentration of matter of mysterious origin is the ultimate cause of all that exists. The problem , however, is that their *god* could not have have started to expand contradicting the laws of the universe. In other words, the primeval ball of fire, containing all the matter of the universe compressed together, could not have started to disperse against its own gravity (Lerner 1990). Regardless of the fact that the big bang theory is self-contradictory from the outset, not much is enticing about the prehistoric philosophical viewpoint of such a naive theory. George Lamitre's insight and Edwin Hubble's discovery do not imply the universe is evolving from a singularity; the universe is evolving from a single point in 4D but not from a matter singularity in 3D.

Now we want to investigate how old is the universe. Let's recall Hubble's law:

$$\frac{\partial s}{\partial t} = H_0 \times s \tag{7}$$

where H_0 is about 75 kilometers per second per megaparsec. From eqs.(3,5) it follows that

$$\frac{\partial s}{\partial t} = GM^*/c^3t^2 \times s \tag{8}$$

By equating the right side of the two equations above we calculated that the universe began 18500×10^6 years ago. Hubble's H_0 can be regarded constant for periods of millions of years, but not forever. From eq.(5) we get that its present radius is only about 0.25 that of its asymptotic value (keep this result in mind). Hence the present distance from planet earth to the farthermost distant object of the universe would be $0.25 \times 25.3 \times \pi \times 10^9$ l.y.

Taking the time derivative of eq.(8) we get

$$\frac{\partial^2 s}{\partial t^2} = (-2t_0/t^3 + t_0^2/t^4) \times s \tag{9}$$

where $t_0 = GM^*/c^3 = 25.3 \times 10^9$ years. The radius of the universe underwent positive acceleration up until $t = 0.5t_0$. When the acceleration of R_u changed from positive to negative, the relative velocity between the two farthermost points in the universe attained the maximum value, $4c \times exp(-2) \times \pi$, equivalent to 1.7 times the velocity of light. Again, special relativity - which relies on the existence of inertial systems of reference moving in straight lines extending with no limits in 3D - cannot be applied on cosmic scale.

Let's keep working on the (x,y) plane in 4D. A photon emitted from an inertial galaxy would be propagating along an expanding circumference at constant velocity, thus drawing a spiral on such plane. Indeed each time the photon completes an orbit it meets the emission point again and again at an ever increasing distance from the geometric origin of the universe. The constancy of the velocity of light is expressed with the Riemann's line element on the plane:

$$c^2 = \left(\frac{\partial s}{\partial t}\right)^2 = g_{ij}\frac{\partial x_i}{\partial t}\frac{\partial x_j}{\partial t} = R_u^2\left(\frac{\partial \Theta}{\partial t}\right)^2 + \left(\frac{\partial R_u}{\partial t}\right)^2 \qquad \Theta = \int_{t_1}^{t_2} dt \sqrt{\frac{c^2}{R^2} - \left(\frac{1}{R}\frac{\partial R}{\partial t}\right)^2} \tag{10}$$

where Θ denotes the time-dependent angle between the emitter-galaxy and the photon. To calculate how far the photon is from the emission point at time t_2, if it was emitted at time t_1, first of all we need to calculate the angle Θ, $(\Theta \leq \pi)$. The distance would be $R(t_2) \times \Theta$.

Now we want to study the red shift caused solely by expansion. Consider a galaxy that starts emitting light of a single frequency in a certain direction and at a certain moment. When the first photon emitted completes the first orbit and meets the emitter galaxy again, the galaxy abruptly stops emitting light . Since all the photons must be at the same radius, what we have is a circumference of light on the (x,y) plane with x wave crests. The x number, however, cannot change when the radius of the circumference (which is the radius of the universe) expands. Hence cosmological red shift at the time of detection (by any inertial galaxy) is given by:

$$\lambda_{emitted} = \frac{R_e}{R_d}\ \lambda_{detected} \tag{11}$$

Since time runs at the same pace for all inertial systems, no Doppler effect exists in the light emitted from one inertial galaxy and detected by another inertial galaxy, no matter if the galaxies are in relative motion. Physical phenomena related with the transformation properties of 4-vectors in special relativity occur when there is an additional relative velocity to that given by expansion. That is, relativistic phenomena occur when the systems of reference move in directions other than the radial direction in 4D (the reader might keep in mind the 2D spherical balloon embedded in 3D to visualize what we are trying to explain) We believe inertial galaxies are merely a model of real galaxies since all of them are subject to gravitational forces exerted by all the other massive bodies in the universe.

Space has no physical properties, therefore it cannot be stretching like chewing gum. What is happening is that more and more points of the 4D space are becoming also points of physical space. The size of particles (electrons, protons, molecules, etc,) does not change. Yet, since space is the very medium through which light propagates, photons are the exception to the rule: the wave length increases while its frequency decreases, this keeps the velocity constant along its trajectory in 4D. The methods and interpretations currently used for determining remoteness of luminous cosmic objects require reviewing, the new approach may help to interpret properly the accumulation of anomalous red shift data (H. Ratcliffe, 2010)

III. THE STEADY STATE DESCRIPTION OF FREE PARTICLES IN SELF-ACTION

Later on we will see that the asymptotic mass of the universe M^* depends on the mass of the eXon (the particle mentioned in the abstract). To be specific about M^* we need to know the electron-eXon mass ratio, which in turn requires us to solve the problem of the electron in self-action. This is the subject matter of the following four sections. We wish to start this section with a question. Why the customary wave equations of quantum mechanics cannot represent a free particle like a small object in fixed position with respect to an inertial system of reference? Now we want to give a clear answer to this question: the Dirac equation is not fundamental, but merely the natural extension of the equation that can describe a free particle in accordance with the first principle of physics. We are saying that the Dirac equation,

$$\gamma_\mu(\partial_\mu - E_\mu)\psi = (M_e c^2)\gamma_m \psi, \tag{12}$$

where $\partial_\mu = \hbar c \nabla_\mu$, must be restricted for the study of the electron under external action E_μ. Under the new perspective, the Dirac free particle equation, $\gamma_\mu \partial_\mu \psi = M_e c^2 \gamma_m \psi$, would apply exclusively in potential problems involving force free regions. Indeed, its solutions are meaningful only when they satisfy boundary conditions. The Dirac free particle solutions without boundary conditions - plane waves uniformly extending throughout space and positrons with negative rest energy - do not represent reality. Why? Because the essence of a free particle is the way it interacts upon itself, if this consideration is not taken into account from the outset; there is no reason to believe the resulting description of a free electron could be meaningful.

We cannot explain why the founders of quantum mechanics did not contemplate what we have just mentioned, but we know that they engaged in futile discussions out of which no consensus was ever reached. For instance, Heisenberg and Bohr believed that the uncertainty relations between wave packets and their Fourier-transforms reveal an intrinsic impossibility to measure with absolute precision the momentum and the position of the particle. In the history of science it is written that Einstein and Schrodinger were in total disagreement with the Copenhagen interpretation. Why? Because they did not see any logical connection between the description of a free particle and its interaction with a measuring devise. Heisenberg ended up denying the existence of objective reality, whereas Einstein believed up to the last of his days that reality was independent of the observer. Despite the usual differences that exist among theoretical physicists, years after the advent of the Schrodinger and the Dirac equations, new generations of physicists were able to agree on one thing: the customary free particle solutions could not be the final quantum description of the free electron: self-action had to be taken into consideration.

By the late 40's - after Richard Feynman and jJulian Schwinger failed in their attempt to apply their techniques to solve the problem of the electron in self-action - physicists realized QED was not adequate to understand the electron. Let me quote some lines of well known lectures on physics (Feynman, 1962). *..... but the difficulties do not disappear in quantum electrodynamics. That is one of the reasons that people have spent so much effort trying to straighten out the classical difficulties, hoping that if they could straighten out the classical difficulty and then make the quantum modifications, everything would be straighten out..... but the answer still comes out infinite unless you cut off an integration somehow - just as we had to stop the classical integrals at $r = a$. So, today, there is no known solution to this problem. We do not know how to make a consistent theory - including the quantum mechanics - which does not produce an infinity for the self-energy of an electron, or any point charge. And at the same time, there is no satisfactory theory that describes a non-point charge. It's an unsolved problem.* The QED approach was doomed to fail from the outset for it is based on a perturbative procedure over the propagator of the Dirac equation, and, hence, that approach cannot describe a particle in accordance with the first principle of physics. New concepts are necessary to explain the very existence of the electron. For that purpose it is essential to realize that (strictly from a mathematical viewpoint) the Coulomb potential cannot have a functional interrelation with a point charge at its singularity:

About 80 years ago mathematicians introduced the weak derivative to extend the concept of differentiation to apply to discontinuous functions; specifically to the Heaviside unit step function (Britannica 1986)

$$H(x) = 0 \quad if \quad x \le 0 \qquad\qquad H(x) = 1 \quad if \quad x > 0. \tag{13}$$

The Dirac functional entered in formal mathematics as shown:

$$\int_{-\epsilon}^{\epsilon} \Big[\frac{\partial H(x)}{\partial x}\Big]_{weak} dx \equiv \int_{-\epsilon}^{\epsilon} \delta(x)dx = 1, \tag{14}$$

where ϵ is arbitrary. The relevance of this most remarkable definition can be appreciated using the differentiable parametric representation of $H(x)$:

$$H(x,\beta) = 0 \;\; if \;\; x \le 0 \quad and \quad H(x,\beta) = \exp(-\beta x^{-1}) \;\; if \;\; x > 0 \tag{15}$$

Similarly to the ϵ, δ interrelation in calculus, in the theory of distributions one must determine the value of a parameter β which can make the subtraction, $\Delta = H(x) - H(x,\beta)$, as small as desired $\forall x$ larger than a prescribed value of x. For instance, if one wishes $\Delta < 10^{-8}$ for $x > 10^{-10}$, then we choose $\beta \le -10^{-10}\ln(1 - 10^{-8})$. Why is all this discussion about the Dirac functional so important? Because now we can see that integral of the divergence of the vector field $\mathbf{E}_0 = \exp(-\beta r^{-1})r^{-3}\mathbf{r}$ satisfies:

$$1/4\pi \lim_{\beta\to 0}\int_{space}(\nabla\cdot\mathbf{E}_0) = \lim_{\beta\to 0}\int_{\beta^2/\epsilon}^{\epsilon}\partial_r e^{-\beta/r}dr = \lim_{\beta\to 0}\int_{\beta^2/\epsilon}^{\epsilon}\delta(r,\beta)dr = \lim_{\beta\to 0}\left(e^{-\beta/\epsilon} - e^{-\epsilon/\beta}\right) = 1 \tag{16}$$

The equation above shows that the electric field corresponding to the Dirac distribution is $\mathbf{E}_0$. To understand this result let's consider a small sphere of charge: the electric field vanishes at the center of the sphere, the field reaches a maximum value at the radius of the sphere an then it starts to fall off like r^{-2}. When the sphere shrinks to become the Dirac distribution, the basic features of the graph of the electric field cannot change. For this reason the graph of $\mathbf{E}_0$ tends to vanish at the origin of coordinates and for this reason the graph has but one maximum at $r_{max} = \beta/2$. The maximum is indefinitely close to the origin of coordinates, but the lower limit of integration is even closer to the origin of coordinates.

The concepts mentioned above, however, make sense only under the integral sign. Why? Because the Dirac delta functional has mathematical meaning exclusively under the integral sign. Some physicists say that the derivative of the function r^{-1} is not defined at $r = 0$ and for that reason we should write $\nabla^2(r^{-1}) = \delta$. Well, in physics we use mathematics to express ideas; if we want to say that no real number is sufficient to describe the magnitude of the C-potential at $r = 0$, then we validate the term r^{-1} also at $r = 0$. In the same vein, the term $-r^{-2}$ represents the derivative of r^{-1} also at $r = 0$. Yes, the slope of the graph of the C-potential is vertical at the origin of coordinates. It follows from all of the above that the integral of the divergence of $\mathbf{E} = r^{-3}\mathbf{r}$ is nil, implying thereby that the Coulomb potential is source-free:

$$-\int_{space}\nabla^2(r^{-1}) = \int_{space}\nabla\cdot r^{-3}\mathbf{r} = 4\pi\int_o^{\infty}\frac{\partial 1}{\partial r}dr = 0 \tag{17}$$

An electrostatic radial field per se cannot exist in empty space. Therefore, if we want to postulate that the C-potential is inherent to the electron, we need to imagine that " something", upon which the C-potential can interact repulsively, must exist around the singularity. The corresponding interaction energy must provide the electron with rest energy. Where else could the electron get its rest energy from? We will refer to that " something" as the *receptor-point* . This new entity together with the C-potential and a gauge invariant potential constitute what we call the electron. The density of probability of the receptor point is given by the square of the wave functions satisfying the fundamental bispinor equation that describes free stable spin-1/2-particles in self-action: the electron, the proton and the eXon mentioned in the abstract. We are extending Max Born's interpretation of the wave function into the realm of particle physics. The new equation contains the bispinor differential operator and the specific self-action 4-vector S_μ corresponding to the particle under study; therefore the fifth matrix γ_m at the right of the Dirac equation does not appear in the fundamental equation:

$$\gamma_\mu(\partial_\mu - S_\mu)\psi = 0, \tag{18}$$

Now the problem is to show both that the electron's receptor point is confined close around the singularity of the C-potential and that the receptor point cannot be at the singularity itself. The solution of this problem is the subject matter of the next sections. A relevant aspect about the fundamental equation is that the fifth matrix is missing. We can say in advance that the fundamental equation will describe the electron and the positron with positive rest energy. Therefore, the interpretation that Dirac gave to the negative energy solutions of his free particle equation cannot be true. In fact *the Dirac sea* is the main source of divergent results in QED.

To finish this section let me make a few comments on the classical electromagnetic theory. The notion that the charge density is the source of the potentials is problematic by itself. For instance, consider the electrostatic energy $\int_{space} \rho\phi$. According to Maxwell's theory the energy density (which is located where the charge density and the potential coexist) can be dispersed by simple vector manipulation throughout space taking the form of the electric field squared. This ambiguity arises because the functional interrelation between the potential and the charge density that Maxwell's theory propounds is fundamentally fictitious. The charge density is merely a practical concept that serves to represent a distribution of electrons with a differentiable function. This, in turn, allows for the evaluation of the overall potential with a differential equation. Actually, the " charge density" in Maxwell's equations should be interpreted as the density of singularities of the electromagnetic potential, but the idea completely fails if applied to a single electron. The net number of singularities is the quantity conserved. From a fundamental viewpoint, plane electromagnetic waves and radial fields are described with the same equation, $\nabla_\mu \nabla_\mu A_\nu = 0$; only the gauge can be different.

In Maxwell's theory the electric charge plays a dual role: it is the source of the potentials and it is also the entity upon which the electromagnetic potential interacts. Since we have learned that the C-potential cannot be associated with a point source at its singularity, we must assume the existence of a receptor-point inherent to the electron. The receptor-point is subject to the action of the C-potential but it cannot be the source of the latter. Although, from a physical viewpoint, the receptor point of the electron exists only in association with the C-potential. And so, if we want to think - merely for practical purposes - that the density of mathematical singularities is the source of the overall potential, we certainly can use the Poisson equation, and all the rest of the electromagnetic theory as well.

IV. THE COVARIANT POTENTIALS ASSOCIATED WITH THE STEADY STATE DESCRIPTION OF FREE PARTICLES IN SELF-ACTION

Consider an electron in arbitrary motion. The description of electromagnetic signals propagating from the singularity of the potentials toward the observation point located at the origin of coordinates involves the 4-vector of zero length,

$$r_k = (r, -\mathbf{r}), \tag{19}$$

With r_k and the 4-velocity of the singularity, $u_k = (1-u^2)^{-1/2}(1, \mathbf{u})$ we get the fundamental invariant

$$I_0 = (r_k u_k)^{-1} \tag{20}$$

- The Lienard-Wichert potentials are obtained directly from the invariant above; there is no need of Maxwell's equations for such purpose.

$$A_\mu = I_0 u_\mu = (1, \mathbf{u})(r + \mathbf{r}\cdot\mathbf{u})^{-1} \tag{21}$$

  The L-W potential 4-vector will be used in the study of the electron and of the proton; it enters eq.(18) as $-e^2(r^{-1}, \mathbf{0})$.

- The gauge invariant potential below is essential for the description of the electron, the proton and the eXon mentioned before. Its presence in eq.(18) is indispensable to get square integrable solutions.

$$\Gamma_\mu = \nabla_\mu I_0 \tag{22}$$

  It enters eq.(18) as $-\imath\hbar^2/M_x(0, r^{-3}\mathbf{r})$. The new coupling constant is imaginary and involves the eXon mass, M_x, with respect to which the electron and the proton masses are measured. The eXon mass is a new fundamental constant.

- The momentum 4-vector is involved in the solution of the three particle also. It enters eq.(18) as

$$P_\mu = Mc^2(1,0,0,0) \tag{23}$$

where M is the mass of the particle under study. This potential is indispensable to interrelate the frequency of the particle $E/\hbar$ - which appears in the time dependent part of the solution - with its rest mass.

- The bispinor description of the proton involves the potential ξ_μ in addition to the potentials involved in the electron-positron solution. The potential ξ_μ is the 4-gradient of a scalar function ξ. The potential and it represents the " strong " interaction the proton exerts upon itself.

$$\xi_\mu = \nabla_\mu \xi \tag{24}$$

Fortunately we need not know the explicit form of this potential; later on we will see why.

V. THE ELECTRON-POSITRON SOLUTION

If the reader wants to follow this section with more detail, we recommend a magnificent monograph about the Dirac equation (Hill, 1938). the reader will note that we made some convenient changes in notation. The Dirac equation involves 4×4 matrices operating over a wave function with 4 components. We are dealing with time-independent potentials which yield the time-dependent solution $exp(-\imath Et/\hbar)$. Since the potentials are radial, the spatial part of the solutions are expressible as the product of radial functions by spherical harmonics, $Y_{l,m}$, already normalized. The general form of the angular solution for each one of the 4 components of the wave function appears in the equation below. In this context, however, the particles can have only spin angular momentum, hence the total angular momentum is $j=1/2$; we will work with the z-component $m=1/2$. Therefore the spatial part of the wave function (which are also valid for the study of the proton and the eXon) are expressible as indicated by the arrow (Hill, 1938),

$$\begin{aligned}
\psi_1 &= \Big(j+1-m/2(j+1)\Big)^{1/2} Y_{j+1/2,m-1/2}F(r) && \to \sqrt{1/3}Y_{1,0}F(r)\\
-\psi_2 &= \Big(j+1+m/2(j+1)\Big)^{1/2} Y_{j+1/2,m+1/2}F(r) && \to \sqrt{2/3}Y_{1,1}F(r)\\
-\imath\psi_3 &= \Big(j+m/2j\Big)^{1/2} Y_{j-1/2,m-1/2}G(r) && \to Y_{0,0}G(r)\\
-\imath\psi_4 &= \Big(j-m/2j\Big)^{1/2} G(r)Y_{j-1/2,m+1/2} && \to 0
\end{aligned} \tag{25}$$

In the study of the electron, eq.(18) transforms in eq (26) for the region inside the classical electron radius

$$\gamma_\mu(\partial_\mu - \Gamma_\mu - A_\mu)\psi = 0, \tag{26}$$

And for the region outside the classical electron radius we have:

$$\gamma_\mu(\partial_\mu - \Gamma_\mu - P_{\mu(e)})\psi = 0, \tag{27}$$

With two equations the probability density of the electron's receptor-point can be confined within the classical electron radius notwithstanding that the wave functions are smoothly continuous throughout space. In addition, since the rest mass is missing in the first equation, we need the second equation to be able to interrelate the frequency of the wave functions with the rest mass. Let's see how this can be accomplished.

Substituting the wave functions of eq.(25) into eq.(26), we get a system of differential radial equations:

$$s^{-2}\partial_s(s^2F) - \beta s^{-2}F = \left(1-s^{-1}\right)\alpha G \qquad -\partial_s G + \beta s^{-2}G = \left(1-s^{-1}\right)\alpha F \tag{28}$$

where $s=(E/e^2)r$ and $\beta = E/\alpha M_x c^2$. Standard analysis leads to two conclusions:
Conclusion(1): the first independent solution of the system can be written as

$$F = a_0 exp(-\beta s^{-1}) \times \sum_{n=0}^{n=\infty} \alpha^{2n+1}F_n(s) \qquad G = a_0 exp(-\beta s^{-1}) \times (1+\sum_{n=0}^{n=\infty} \alpha^{2(n+1)}G_{n+1}(s)) \tag{29}$$

where a_0 is an arbitrary numerical constant and where all functions F_n and G_{n+1} as well as their first derivatives vanish at $s = 1$. The contribution of the gauge invariant potential to the solution is the factor function

$$exp(-E/\alpha M_x c^2 \times s^{-1}) \tag{30}$$

The method of solution is iterative and it is based in the comparison of terms in equal powers of α. Let's recall that the generators of the two independent radial solutions satisfy eqs. (28) when α and β are considered null. Hence the iteration process for the first independent radial solution starts with the generator $G_0 = 1$ into: $s^{-2}\partial_s(s^2 F_0) = (1 - 1/s)G_0$. The integral is performed and the constant of integration makes the function F_0 vanish at $s = 1$. So we get $F_0 = 1/6(s^{-2} - 3 + 2s)$. In order to obtain G_1 we substitute F_0 into: $-\partial_s G_1 = \left(1 - s^{-1}\right) F_0$. The integral is performed and the constant of integration makes the function G_1 vanish at $s = 1$, and so on with no end.

The radial equations corresponding to eq.(27) are

$$s^{-2}\partial_s(s^2 F) - \beta s^{-2} F = \alpha\left(1 - M_e c^2/E\right) G \qquad - \partial_s G + \beta s^{-2} G = \alpha\left(1 - M_e c^2/E\right) F, \tag{31}$$

The solution,

$$F = 0, \qquad G = a_0 \exp(-\beta s^{-1}), \qquad E = M_e c^2 \tag{32}$$

smoothly joins with the solutions in eqs.(29). Therefore the first solution is smoothly continuous throughout space.

Conclusion(2): the second independent solution of system (28), denoted as (f,g), can be written as

$$f = b_0 exp(-\beta s^{-1}) \times (s^{-2} + \sum_{n=0}^{n=\infty} \alpha^{2(n+1)} f_{n+1}(s)) \qquad g = b_0 exp(-\beta s^{-1}) \times \sum_{n=0}^{n=\infty} \alpha^{2n+1} g_n(s) \tag{33}$$

where all functions $f_{n+1}(s)$ and $g_n(s)$ and also their first derivatives vanish at the classical electron radius, $s = 1$. This time we start substituting the generator $f_0 = s^{-2}$ into $-\partial_s g_0 = \left(1 - s^{-1}\right) f_0$ and proceed to determine the function g_0 and so on with no end. The second solution of system (31),

$$f = b_0 s^{-2} \exp(-\beta s^{-1}) \qquad g = 0, \tag{34}$$

also smoothly joins with the solutions given by eqs.(33). The second solution is smoothly continuous throughout space.
The simplest invariant scalar function that can be made up with the elements of the theory involves the γ_m matrix in eq.(12):

$$I_e = 1/2(u_\mu \psi \gamma_\mu \psi^* + \psi \gamma_m \psi^*) = \psi_1 \psi_2^* + \psi_2 \psi_2^* = (1/3|Y_{1,0}|^2 + 2/3|Y_{1,1}|^2) F f \ = (4\pi)^{-1} F f \tag{35}$$

where $\gamma_m = Diag(1, 1, -1, -1)$ and $\gamma_t = Diag(1, 1, 1, 1)$ and $u_\mu = (1, 0, 0, 0)$. Here ψ represents the wave function corresponding to the first radial solution while ψ^* represents the complex conjugate wave function corresponding to the second radial solution. In first approximation we get

$$I_e = a_0 b_0 (\alpha/6)(4\pi)^{-1} \exp\left(- 2\alpha^{-1}(M_e/M_x) s^{-1}\right) \times \left[(s^{-2} - 3 + 2s)s^{-2}\right] \tag{36}$$

It is an amazing mathematical feature that the product of the two independent solutions of eq.(27) is null beyond the classical electron radius (see eqs.(32, 34)). This feature suggests that I_e in eq.(35) be defined as the probability density of the electron's receptor point. It is important to note that the electron interacts over other electrons as a point particle since the interacting potential is the C-potential. The individual components of I_e, namely $\psi_1 \psi_2^*$ and $\psi_2 \psi_2^*$, revolve with definite angular momentum around nothing else but the singularity of the potentials. They carry 1/3 and 2/3 of the probability density of the receptor point. The probability that the electron's receptor point could exist between $s = 0$ and $s = s_0$ is therefore:

$$\int_0^{s_0} I_e s^2 ds \left(\int_0^1 I_e s^2 ds \right)^{-1} \tag{37}$$

The expression above will play an essential role in the determination of the electromagnetic coupling constant. Most importantly, eq.(18) has a second solution corresponding to the positron; the same wave functions are arranged in a different order than in eqs.(25):

$$\begin{aligned} &\psi_1 = \imath \ \ Y_{0,0} \times G(r) \\ &\psi_2 = 0 \\ &\psi_3 = \sqrt{1/3} \ \ Y_{1,0} \times F(r) \\ &\psi_4 = -\sqrt{2/3} \ \ Y_{1,1} \times F(r) \end{aligned} \tag{38}$$

The z-component of the magnetization density is represented with the expression on the left whereas the z- component of the spin density is represented with expression on the right(Hill, 1938),

$$-\psi_1\psi_1^* + \psi_2\psi_2^* + \psi_3\psi_3^* - \psi_4\psi_4^* \qquad\qquad -\psi_1\psi_1^* + \psi_2\psi_2^* - \psi_3\psi_3^* + \psi_4\psi_4^* \tag{39}$$

Very easy to verify that the spin density is the same for both particles but the magnetization density of the electron is the negative of the positron's. This is the real difference between the particles.

VI. THEORETICAL VALUE OF α

To continue with the study of the free electron we need to express the ratio M_e/M_x as a function of α, which so far is a free parameter. For the purpose in question we let I_e in eq.(36) satisfy:

$$\int_{space} \ln I_e = [A] + [B] + [C] + [D] = 0 \tag{40}$$

where
$[A] = \int_{space} \ln \exp\left(-2\alpha^{-1}(M_e/M_x)s^{-1}\right)$
$[B] = \int_{space} \ln a_0(4\pi)^{-1}$, here the angular normalization factor is eliminated by choosing $a_0 = 4\pi$
$[C] = \int_{space} \ln b_0(\alpha/6)$, here we let $b_0 = \alpha^{-k-1}$. This is the simplest possible function of α with a free parameter k allowing us to show that α was determined as shown below .
$[D] = \int_0^1 \ln\left[(s^{-2} - 3 + 2s)/s^2\right] s^2 ds \approx -0.4769093\ldots$
Thus eq.(40) yields

$$3M_e = M_x(-k\alpha \ln\alpha - 3.22249\alpha) \tag{41}$$

Now the consideration is made that the metaphysical intelligence that designed the universe fixed the value of α to allow for the electron mass to have maximum value with respect to the eXon's fundamental mass.

$$\partial_\alpha(M_e/M_x) = 0 \tag{42}$$

which yields,

$$k \ln\alpha + 3.22249 + k = 0. \tag{43}$$

Adding eqs.(41) and (43) we get

$$k = 3M_e/\alpha M_x \tag{44}$$

The probabilistic interpretation should play a real role in the theory: we will assume that the expectation value of the reciprocal of the distance of the receptor-point from the singularity of the potential yields the energy of the two masses involved in the equation. Evidently we are talking about the expectation value of the C-potential itself, equivalent to the coupling of the C-potential with the probability density of the receptor-point:

$$\hbar\ c \int_{space} I_e (A_\mu A_\mu)^{1/2} = \int_{space} I_e\left[M_e c^2 + M_x c^2\right] \tag{45}$$

This equation is equivalent to:,

$$\int_0^1 [1/s - 3/k - \alpha]\,[\exp(-2k/3s)](s^{-2} - 3 + 2s)ds = 0 \tag{46}$$

Substituting α from eq.(43) into eq.(46) we get an equation for k. With MATLAB we get $k = 0.82129\ldots$. Again, from eqs.(43,44) we get,

$$\alpha^{-1} = 137.51 \qquad M_x = 502.26 M_e \tag{47}$$

This result differs very little from the experimental value: $\alpha = 1/137.04$.

VII. THE ELECTRON-PROTON MASS RATIO

The proton description in this context perhaps is naive in light of the evidence of the complex structure of this particle. Nevertheless the bispinor steady state description is important because it allows us to interrelate the masses of the electron and the proton: the wave functions of the proton's-receptor-point are obtained with an additional potential to those of the electron-positron solution. See eqs (26,27):

$$\gamma_\mu(\partial_\mu - A_\mu - \Gamma_\mu - \xi_\mu)\psi = 0, \quad r \le e^2/M_p c^2 \qquad \gamma_\mu(\partial_\mu - P_{\mu(p)} - \Gamma_\mu - \xi_\mu)\psi = 0, \quad r > e^2/M_p c^2 \tag{48}$$

The reader can easily infer that the proton solution would be different from the electron-positron solution only because the additional potential ξ_μ contributes to the solution with an exponential function with imaginary argument. Therefore the proton's fundamental invariant would differ from the electron's only in the subscript of the mass parameter. To avoid redundancy the solutions must describe different particles. This can be accomplished if we interrelate the solutions the simplest possible way. We let $M_e/\alpha M_x$ and $M_p/\alpha M_x$ (in eq.(30)) to transform into M_x/M_p and M_x/M_e respectively. This requirement would imply

$$M_e M_p / M_x M_x = \alpha \tag{49}$$

From eq.(47) we get $M_p = 1834.52 M_e$. The experimental value is $M_p = 1836.01 M_e$. The bispinor steady state description of the electron and the proton complies with the first principle of physics but it is not a complete theory. The final theory about these particles should account for the value of their magnetic moment and should explain the true nature of quarks.

VIII. THE EXON; THE ASYMPTOTIC MASS M^*; THE CRITICAL LENGTH Λ_0

The equation describing the eXon takes the form

$$\gamma_\mu(\partial_\mu - \Gamma_\mu - P_{\mu(x)})\psi = 0, \tag{50}$$

which is equivalent to the " external solution " of the electron-positron case (eq. 27), but this time the solution given by eq.(34) is valid throughout space. The corresponding fundamental invariant,

$$4\pi u_\mu \psi \gamma_\mu \psi^* = s^{-4} \exp\left(-2s^{-1}\right) \tag{51}$$

where $s = (M_x c/\hbar) r$, follows from the fact that the γ_t matrix is the unit matrix and $u_\mu = (1, 0, 0, 0)$ is the 4-velocity of the singularity of the eXon self-potential.

In contrast with the solutions of the electron and the proton, the probability density of the eXon's receptor point is not totally confined. Nevertheless, for all computational purposes, we can describe the eXon like a quasi-point particle provided we redefine the probability density by multiplying the invariant above by another invariant, namely $(\Gamma_\mu \Gamma_\mu)^{M^*/M_x}$.

Presumably dark matter are eXons satisfying the simplest possible steady state solution of the bispinor fundamental equation. Why is this particle so important for the understanding of the universe? We know that it provides galaxies with rotational stability, but what else? Note that equations (6) and (51) are mathematically identical. Equation (6) appears in the study of the universe whereas equation (51) appears in the study of the eXon. The first involves G and the second, $\hbar$. Now we can believe that the metaphysical intelligence that designed the universe defined the asymptotic energy of the universe by interrelating all the constants involved in physical genesis:

$$\frac{GM^* M_x}{\hbar c} = \frac{\hbar c}{G M_p M_e} \qquad M^* = 3.24 \times 10^{53} Kg. \tag{52}$$

The asymptotic mass is equivalent 15 times the mass of 10^{11} galaxies each containing 10^{11} stars with a solar mass. Such an enormous mass falls within the very wide range of *the mass of the universe* that astronomers handle nowadays (McPershon, 2006), even if only 1/4 of it exists at the present time.

The square root of the product of GM^*/c^2 and $\hbar/M_x c$, gives further meaning to the fundamental constants: we believe it is the critical radius mentioned in the first section:

$$\Lambda_0 = \sqrt{\frac{G\hbar}{c^3}} \times \sqrt{\frac{M^*}{M_x}} \approx 430km. \tag{53}$$

Some big bang theorists are trying to study what exactly happened during the first trillionth of a trillionth of a second after that precise moment they arbitrarily decided to name time-zero, which is when they think free quarks started to combin to form baryons. I doubt such investigation makes sense. To represent a real beginning of physical time it is indispensable to use the principle of creation: zero-energy started to split up in positive and negative energies by divine grace.

IX. THE FORMATION OF ORDINARY MATTER

Fortunately the principle of creation does not specify where exactly the negative gravitational potential energy is building up. Local conservation of energy is not necessary. We will postulate that randomly distributed spontaneous high energy pair production of eXons in empty space offsets the negative gravitational energy that builds up. Because the electron and the proton are described as eXons with extra potentials, we will also postulate that ultimately the electron and the proton exist as a consequence of high energy eXon inter-collisions which give place to neutron pair production. Baryon asymmetry is always on the rise, although, asymmetrical baryon production in the lab is impossible since eXons cannot be trapped to be induced to inter-collide. According to astronomical observations the ratio (visible matter/dark matter) is small. Therefore only a small percentage of eXons eventually transforms into electrons and protons; the vast majority of the eXons being produced end up playing the role of dark matter. Consider that eXons need kinetic energy of about 3 times their rest mass to allow for neutron pair production. This consideration is essential to determine the thermodynamic distribution of eXon pair production. Why do we have neutron (and not anti-neutron) pair production if baryon conservation law is to be broken anyway? Maybe because nature prefers the spin-magnetic moment ratio corresponding to the electron.

The random nature of eXon pair production in physical space, together with the constrains of geometry and the action of gravity, might all be correlated with the network of galactic superstructures that pervade the universe. Evidently computer simulation is necessary to verify this conjecture. When the universe gets to be GM^*/c^3 old, its tangible energy will be $M^*c^2 \times e^{-1}$. We would like to believe that the moment will come when eXon pair production will cease and a new era of photon pair production will start. Therefore the last 63 per cent of the asymptotic energy of the universe merely will contribute to the electromagnetic radiation background, not necessarily as microwaves. The cosmic unit of time GM^*/c^3 might also define how often another universe similar to ours is born. Physical space is to the infinite 4D Euclidean space what a point is to the line; our universe could not be the only one (R. Joseph 2010).

If we could see the motion picture of the universe running backwards, distant galaxies would start to approach one another while their matter content diminished. At the end of the contraction period, all forms of energy would have wholly disappeared at that precise point where four mutually orthogonal axes converged. Ask not how that is possible, but rather how the universe could possibly have started to exist otherwise.

ACKNOWLEDGEMENTS
I appreciate very much the helpful comments of my friend Carlos R. Lucatero, his expertise in mathematical logic convince me of the relevance of this discipline in theoretical physics. The generous financial aid of the Charles Ness Peha foundation was important for the completion of this work.

REFERENCES

Arp,H.C., G. Burbidge, Hoyle, F. Narlikar, J.V. Wickramasinghe, N.C. (1990) The Extragalactic Universe: An alternative View. Nature, 346, 897-912

Ashwini Kumar Lal (2010). Big Bang? A Critical Review. Journal of Cosmology,6,1533-1547

Britannica, 13,519, 13th edition

Eastman,E.T. (2009). Cosmic Agnosticism, Revisited. Journal of Cosmology,4,655-663

Feynman,P.R. (1962). Lectures on Physics 2,28,10.

Gugluicci, N. (2006).Quasars Show no Time Dilation, www.physorg.com/news190027752.html

Hill, E.L., Lanshoff, R. (1938) The Dirac Electron Theory. Rev.Mod.Phys., 10, 87-118

Joseph, R. (2010). The Infinite Universe vs the Myth of the Big Bang: Red shifts, black Holes, Acceleration, Life. Journal of Cosmology, 6, 1548-1615

Lerner, E.J. (1990)The Big Bang Never Happened, Random House, New York.

McPherson, K.hypertextbook.com/facts/2006/KristineMcPherson.shtml

Ponce de Leon, J. (2004) Extra Symmetry in the Field Equations in 5D. Class. Quant. Grav, 23, 3043

Ratcliffe,H. (2010). Anomalous Red Shift Data and the Myth of Cosmological Distance. Journal of Cosmology. 4,693-718

Van Flandern, T.C.(2002). The Top 30 Problems with the Big Bang. Meta Research Bulletin 11,6-13.