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Research Article

The Machinery of the Universe

Cold start with two particles, Big Bang, splitting of Matter and Antimatter and accelerated Expansion of the Universe

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Abstract

There are three concepts available for understanding the machinery of the universe, A maximum velocity (c) and two basic particles; one with a charge of ⅓ of an electron and another with a charge of ⅓ of a positron. These particles are contained in two spheres. The spheres are collided together with velocity (c). In this Big Bang almost static photons are formed that are the basis for all fields. Some of these photons react further with 1-3 basic particles of the same charge to form proto-quarks and proto-leptons. These, very reactive, proto-particles react further with static photons to form more stable spherical particles and ultimately u and d quarks and electrons.

Mass and energy manifest themselves by polarisation of static photons forming a field. Forces including gravity are all electromagnetic and the result of interacting field photons.

These results imply that matter and antimatter repulse each other, that in turn implies an expanding universe.

Keywords

Cosmology, Gravitation, Big Bang, Symmetric Universe, Photons, Fields, Energy, Matter, Antimatter.

Introduction

Notions as mass, forces, gravity, energy and fields are used without understanding their machinery. Therefore, it is necessary to understand the very start of the universe. In literature one can find that the universe started with a 0. 17 m diameter ball that for unknown reasons explode with a Big Bang [1]. Instead, it is proposed to split the volume of the ball in two 0.135 m diameter spheres, one containing densely packed basic particles with a charge of ⅓ of an electron and the other with a charge of ⅓ of a positron. Fig.1 [2]. The particles inside each sphere will not repulse each other because there are no fields yet. For the same reason the two spheres will not attract each other. Not knowing how spheres are brought together it becomes plausible that it is with a velocity (c). This implies a low temperature, low entropy start of the universe. The collision results in the Big Bang.

Fig.1 Colliding spheres of positive and negative basic particles at the start of the universe

The first dumbbell shaped particles formed upon collision are very high-energy photons essential for the formation of fields. Also the gravitational field? Yes, it was Feynman who ventured already that eventually it may be discovered that gravitation has an electromagnetic origin [3]. He based this assumption on the fact that both electromagnetic forces and gravitation are inversely proportional to the distance of bodies. Later hefty events as gravitational waves appear to travel with velocities of almost *(c)* supporting Feynman's idea. If gravitation is an electromagnetic force, this implies that matter and antimatter repulse each other and so violates the Weak

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Equivalence Principle (WEP) [4]. Research with antihydrogen atoms seems to confirm the WEP. However, these experiments were carried out in very strong magnetic fields that could affect the behaviour of the antihydrogen atoms if gravity is an electromagnetic force [5].

Proto Quarks and Leptons

A very small portion of these high energy photons with a spin *h* reacts with additional basic particles. When a positive basic particle in a photon is successfully hit by a second negative basic particle a proto-quark is formed with a charge of ⅓ of an electron and a spin ½*h* [2]. This rarely occurs as the fast spinning negative basic particle in the photon mostly kicks away an additional negative basic particle. A proto-quark with a charge of ⅔ e is formed when the positive centre basic particle hit by an additional negative basic particle. The positive basic particle in proto- quarks is more accessible for reaction with a negative basic particle. Finally, a proto- lepton with a charge of e will form when the

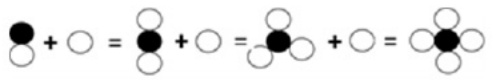

Fig. 2 Formation of proto- quarks and leptons by collision of a static photon with one, two and three basic particles with the same charge

central positive particle in a proto-quark with a charge of ⅔ *e* is hit by yet another negative basic particle. The spin remains ½*h* for all these particles (Fig. 2). In a similar way positive proto-quarks and leptons are formed Fig. 3.

Fig. 3

Equal amounts of matter and antimatter were produced in the Big Bang. However, the majority of scientists believe that only matter did survive. The reason is that one will not accept that matter and antimatter repulse each other, although this is obvious when gravity is an electromagnetic force. Another argument is that it beautifully explains the accelerated expansion of the universe discussed below [7].

Symmetry and Stability

Assuming a positive basic particle to be at the centre of a tetrahedron with the four negative basic particles located at the vertices, the simplest body with a symmetrical spatial charge distribution is obtained in this proto- lepton. Such a symmetrical distribution of charge in three dimensions is apparently a requirement to ensure stability. Because proto quarks and leptons are unstable, they have to react and surround themselves with photons to obtain a more stable spherical form. This process occurs in various stages corresponding to many *flavours*, until they have reached the flavour of present matter comprising *u* and *d* quarks and electrons and their corresponding opposite matter particles.

For quarks having a fractional charge, a symmetrical spatial distribution of charge is not possible. The only way to form a more stable particle is to team up with one or two quarks in such a way that the charge becomes either zero, or one or two times that of the electron or positron. For mesons that consist of two quarks, this always results in a particle that lacks symmetry in the charge distribution along the axis connecting the two quarks, which may well be the reason mesons are short lived. An interesting aspect of mesons consisting of a quark and its anti-quark is that such mesons can neither be considered matter nor antimatter. The same holds for positronium. It would be interesting to investigate the gravitational behaviour of these particles.

For particles consisting of three quarks, more symmetrical configurations are possible than for mesons. This is particularly pronounced for the proton as shown in Fig. 4. An isolated neutron is less symmetric than the proton and this may explain the fact that it is less stable. For simplicity, the particles in Figs. 2, 3 and 4 are given in two dimensions.

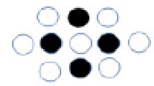

Fig. 4 Arrangement of basic particles in a proto- proton

Energy

Energy manifests itself as polarisation of the field photons. Forces between bodies are transmitted by polarisation of field photons.

The mass of the total universe is estimated to amount to 3.8E55 kg or 3.4E72 J. The energy in particles is only a fraction of the energy in field photons. Therefore, the energy stored in all field photons must be orders of magnitude higher and the radius of basic particles correspondingly lower as shown in Table I.

Table I
Energy of field photons and of the total universe as a function of the radius of basic particles

Basic particles				Field photons		Universe
Radius R	volume	number	2πR	frequency	energy	energy
m	m^3	in sphere	m	1/s	J	J
1E-20	4E-60	3E56	6E-20	5E27	3E-6	1E51
1E-25	4E-75	3E71	6E-25	5E32	3E-1	1E71
1E-30	4E-90	3E86	6E-30	5E37	3E+4	1E91
1E-35	4E-105	3E101	6E-35	5E42	3E+9	1E111
1E-40	4E-120	3E116	6E-40	5E47	3E+14	1E131
1E-70	4E-210	3E206	6E-70	5E77	3E+44	1E251

Photons

The sum of the rotational and translational velocity of photons may not exceed *(c)*. Hence, the field photon has hardly any translational velocity whereas photons that move with a translational velocity of almost *(c)* have a relatively small rotational velocity. In Table II the translational velocities are given for photons with a wide range of energies for a radius of a basic particle of 1E-30 m. It appears that for all familiar frequencies: light, X-ray, radio, etc., the translational velocity is very close to *(c)*. It implies that red ligth travels slightly faster than blue light.

Table II Translational velocity of photons as a function of their frequency				
Radius	**2πR**	**Frequency**	**Rotational velocity**	**Translational velocity**
m	m	1/s	m/s	m/s
1E-30	6E-30	4.8E37	3.0E+8	0
1E-30	6E-30	4.3E14	2.7E-15	~3E8
1E-30	6E-30	7.6E14	4.8E-15	~3E8
1E-30	6E-30	3.0E16	1.9E-13	~3E8
1E-30	6E-30	3.0E19	1.9E-10	~3E8
1E-30	6E-30	2.4E28	0.15	~3E8

Calculations

The most important conclusion of the preceeding sections is that matter and antimatter repulse each other resulting in expansion [6,7]. However, many conclusions can be derived from *Gedankenexperimenten* for a one-dimentional universe discussed in this section. In the calculations the following assumptions were made:

- All bodies have a spherical shape and a fixed radius independent of their mass
- Distances between bodies are distances between their centers of mass
- The initial centre to centre distance between adjacent bodies is identical
- All bodies are at rest at time zero
- When bodies of similar matter collide, they will coalesce to one body.

In or shortly after the Big Bang the separation between matter and antimatter occurred and the proto particles reacted with photons that increased their stability.

The universe started with very small particles packed and currently features galaxies and clusters separated by huge distances. For each consecutive step the masses, distances and time increments are different. In the calculations standard bodies with an average mass of 1 kg and a radius of 1 m were used. In the figures data are given in SI units for standard bodies (m, m/s, and m/s^2). These can be converted to actual data for galaxies and clusters as well as for their much smaller precursors, provided the group of bodies has the same gravitational mass distribution, a congruent initial spatial distribution and the same dimensionless *Jacob (J)* number. The *(J)* number is defined as:

$$J = \frac{GM\Delta t^2}{D^3} \qquad (1)$$

where G is the gravitational constant, M is the (average) inertial mass of the group of bodies, Δt is the time interval used in the calculations and D is the initial distance between adjacent bodies. The standard data given in the figures can be converted into data of galaxies and clusters, for example, by multiplying by the conversion factors given in Table III. In these calculations *J* values of 0.04 have been applied to ensure a time interval giving smooth trajectories of the bodies. A smaller *J* value implies a smaller time interval, resulting in more accurate results.

TableI III Multiplication factors for converting standard data into data for galaxies and clusters (ref.7)					
Variable	**Mass**	**Radius**	**Velocity**	**Acceleration**	**Time unit**
	kg	M	m/s	m/ss	s
Standard	1	1	1	1	6.9E4
Galaxy	2E41	1.5E20	3.7E10	6.16E5	2.9E14
Cluster	6E45	5E 22	3.5E11	1.66E5	1.0E16

Distances are defined as a number ≥2 times their radius. Distances between other bodies are obtained by multiplying their radii by the 1 m for standard bodies. Masses of other bodies are obtained by multiplying their (average) mass by the 1 kg for the standard bodies. This also holds for the velocities and accelerations of other bodies. The value in seconds of one time unit for the all bodies is calculated with formula (1).

Calculations for the expansion of the universe started with the study of the behavior over time of a group consisting of 16 standard bodies of alternating matter and antimatter, all with equal inertial mass and equal initial distance between adjacent bodies Fig. 5c. All distances in this section are given relative to the common center of the system at time zero.

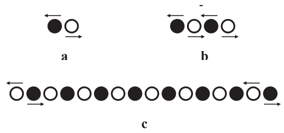

Fig. 5 Initial movements of black matter and white antimatter bodies in one dimension

Velocity, distance and acceleration of the 16 bodies as a function of time are shown in *Fig. 6a, Fig. 6b,* and *Fig. 6c.*

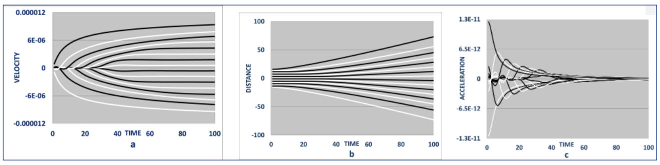

Fig. 6 Velocities (a), distances (b) and acceleration (c) as a function of time for 16 bodies of alternating matter (black lines) and antimatter (white lines) in one dimension. Initial distance between bodies 2.1 times the body radius

The velocities behave primarily rather erratically. This is best illustrated in Fig. 5b comprising four bodies where the resultant force of the other three bodies makes that the two inner bodies move initially inwards rather than outwards. After this initial erratic period, the velocities start to increase and eventually become almost constant. During the whole process each body has neighbors of opposite matter. Furthermore, the differences in velocities between adjacent bodies (Δv) tend to converge to the same value Fig. 6a. As a result, the distances between adjacent bodies also tend to converge to the same value Fig. 6b. From the data in Fig. 6a and Fig. 6b it can be concluded that after a certain time, the same recessional velocities and distances would be observed at other locations in the "universe", which is in agreement with the cosmological principle. The initially high acceleration rapidly drops during the first 100 time units Fig. 6c, (ref.8). The initial potential energy of the bodies (Epot) is approximately proportional to the number of bodies (2N).

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$$E_{pot} = \frac{GM^2(2N\ln 2 - 1)}{D} \approx \frac{2GM^2N\ln 2}{D} \qquad (2)$$

M is the inertial mass of the bodies, G is the gravitational constant and the initial distance between adjacent bodies is D. When the velocities become constant the potential energy becomes zero and the kinetic energy (E_{kin}), because of the almost identical differences in velocities between adjacent bodies, (Δv see Fig. 5a) may be written as:

$$E_{kin} = \frac{N(N+1)(2N+1)}{6} M\Delta v^2 \approx \frac{N^3}{3} M\,\Delta v^2 \quad (3)$$

Equating the simplified equations in (2) and (3) results in:

$$N^2\ \Delta v^2 \approx \frac{6GM}{D}\ln 2 \qquad (4)$$

The maximum velocity (vmax) away from the center is $N\Delta v$. Hence:

$$v_{max} \approx \sqrt{\frac{6GM\ln 2}{D}} \qquad (5)$$

For large values of N *vmax is almost independent of* N and only dependent on M and D. This is about twice the maximum velocity a matter body and an antimatter body, each with the same inertial mass M, will eventually obtain when placed at the same initial distance D ($v_{max}=\sqrt{(GM/D)}$ see Fig. 5a. Although the assumptions of this one dimensional case with equal inertial masses of alternating matter and antimatter were of the utmost simplicity, they already support five observations: expansion, accelerated expansion, a very high initial acceleration and implicitly Hubble's law and the cosmological principle. The above study has been repeated for bodies with different masses where matter and antimatter are not uniformly distributed. In Fig. 7a and Fig. 7b the inertial masses of the original 16 and of the 9 remaining bodies are shown. The bars in Fig. 7b show that matter and antimatter bodies alternate.

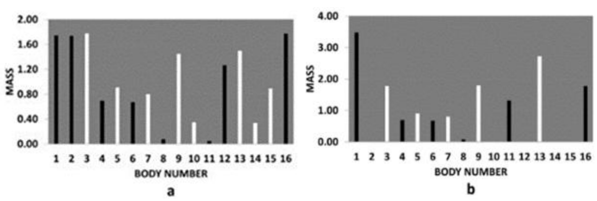

Fig. 7 Mass distribution of matter (black bars) and antimatter (white bars) at time zero (a) and at time 3000 (b)

The result for the distance-time relationship of the 16 adjacent bodies is given in Fig. 8a and in detail in Fig. 8b. Adjacent bodies of the same (anti)matter coalesce almost immediately. The distances behave more erratically than for bodies having the same mass and only after about 600 time units does a pattern emerge where matter and antimatter bodies consistently alternate. Bodies of matter are pushing apart their antimatter neighbors and vice versa resulting in expansion.

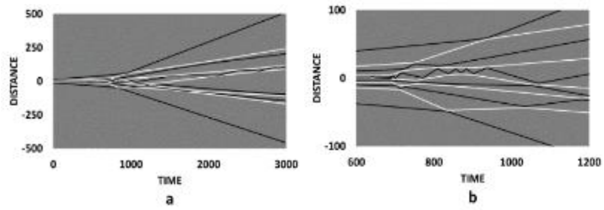

Fig. 8 Expansion and coalescence 16 matter (black lines) and antimatter (white lines) bodies of different mass. Initial distance between bodies 2.4 times the body radius. Fig. 8b is a detail of Fig.8a

The example for a one-dimensional universe is also applicable for a pencil beam thorough the universe shortly after the Big Bang.

Fields

Fields are created by the presence of bodies. This means that there is nowhere a virgin field with random orientation of photons in the universe. Like all photons the essentially almost static field photons have an energy/frequency ratio of Planck's constant (h) and are the building blocks for all fields.

Mass, Gravitation and Forces

Mass, Coulomb forces and gravitation make themselves manifest by polarisation of the (almost) static photons around bodies. Acceleration of bodies results in more polarisation. In the Big Bang the separation of matter and antimatter started. The fact that the "gravitational" force would have been larger than the Coulomb force is plausible as smaller more energetic particles have a larger mass *(e.g. electron, muon, taon)* whereas charges remain the same. This implies that there must be many more flavours that the three in this example.

Mass manifests itself by polarising photons and creating a field that corresponds to a certain amount of energy. Inertial mass and gravitational mass lead to the same amount of polarisation and underpin the Equivalence Principle. The degree of polarisation is the same for matter and antimatter although the orientation of the field photons is reversed.

Mass Defect

The new perspective at gravity and fields also requires a new look at mass. What causes mass? It creates a field by polarisation of surrounding photons. When it creates an electromagnetic field how can the mass defect be interpreted? In accelerators the ratio e/m is attributed to a mass defect of $1/\sqrt{(1-v^2/c^2)}$. Why not to a charge defect of $\sqrt{(1-v^2/c^2)}$? Applying this charge defect to the constituent charges in both atoms and neutrons results in a very small attractive force because the negative charges having a somewhat higher velocity are concentrated at their peripheries. By changing charges, the same results for antimatter are obtained.

Conclusions

With a minimum of assumptions, a new view of the universe is given in which only two basic particles are required. The universe starts with a low entropy by colliding oppositely charged basic particles followed by the Big Bang. In the Big Bang the separation between matter and antimatter occurs because matter and antimatter repulse each other. This implies an accelerated expansion of the universe. Further the model explains the machinery for mass, the Coulomb force, gravity, energy and fields.

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Euclides and the Universe

A problem with all attempts to get a good 3D picture of the universe is that everything is based on “optical” observations whether infrared, radio, x-ray or gamma rays. Optical distances are for two reasons not Euclidean distances. Nowhere space and time are so intertwined as in interpreting optical data. Hence, it is very difficult to get a Euclidian picture of the universe at a certain time. Moreover, gravitational lensing implies that there must be an infinite amount of gravitational prisming. That makes it uncertain in what direction an object is located. For an observer a faraway object that seemingly moves away may be nearby and hardly moving. The greater the distance, the more serious the uncertainty. For a good map of the universe a model is required that can then be gauged with nearby observations. In the model the option of a symmetric universe should be taken into account.