ELEMEN TS
and
ANTI-ELEMENTS
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THE SUPERWORLD

(9 + 1 + 1) = 11 ≡ B ; 32 ≡ F

43 = Dim

Total number of Dimensions

Space Coupling Time

Bosonic Dimensions

Fermionic Dimensions

4 expanded + 7 compactified
32 Dimensions all remain compactified

THE THREE FUNDAMENTAL FORCES

$F_{EW}$
Electroweak: The force acting between quarks & leptons

$F_{QCD}$
Quantum ChromoDynamics: The force acting between quarks & gluons

$F_G$
The Gravitational Force

THREE GAUGE CHARGES, $Q_G$, FOR THE THREE FUNDAMENTAL FORCES

THREE COLUMNS OF LEPTONS AND QUARKS WITH TWELVE FLAVOUR CHARGES $Q_f$

$\nu_e$ ; $\nu_\mu$ ; $\nu_{HL}$

$e^-$ ; $\mu^-$ ; $H_L$

$u$ ; $c$ ; $t$

$d$ ; $s$ ; $b$

1967

1975

TWELVE $Q_f$ FOR THE THREE COLUMNS

s ; t ; m ; E ; $\sigma$ ; $Q_G$ “Subnuclear Colour” Charges ; $Q_f$ “Subnuclear Flavour” Charges

Space Time Mass Energy Spin (generating the Fundamental Forces) (responsible for the stability of Matter).

SEVEN BASIC QUANTITIES

$c \neq \infty \equiv$ Fundamental Constant ; $h \neq 0 \equiv$ Fundamental Constant

Figure 1A
THE UNIFICATION OF ALL FUNDAMENTAL FORCES AND THE EGM EFFECT

The three lines \((\alpha_1^{-1}, \alpha_2^{-1}, \alpha_3^{-1})\) in Figure 4 result from calculations executed with a supercomputer using the following system of equations:

\[
\frac{d\alpha_i}{d\mu} = \frac{b_i}{2\pi} \alpha_i^2 + \sum_j \frac{b_{ij}}{8\pi^2} \alpha_i \alpha_j
\]

\(\alpha_i, \alpha_j\) (with \(i = 1, 2, 3\); and \(j = 1, 2, 3\) but \(i \neq j\)).

This is a system of coupled non-linear differential equations which is valid to mathematically describe an experiment where three quantities play a fundamental role. In our case the three fundamental quantities are the gauge couplings \((\alpha_1, \alpha_2, \alpha_3)\) which vary with “\(\mu\)”, the basic parameter which depends on the energy of the elementary process, from the maximum level of Energy (Planck Scale) to the energy level of our world (NOW). During more than ten years (from 1979 to 1991), no one had realized that the energy threshold for the existence of the Superworld was strongly dependent on the “running” of the masses.

This is now called: the \textbf{EGM effect} (from the initials of Evolution of Gaugino Masses). This effect produces a factor 700 in the threshold for the lightest supersymmetric particle. No one knows the value of the threshold Energy for the production of the lightest supersymmetric particle. The EGM effect lowers this value by a factor 700. Suppose that somebody would say that the \textbf{threshold is at 700 TeV; thanks to the EGM effect} this value is going to \textbf{be 1 TeV}. In Figure 5 the details in the high energy range indicate the existence of a GAP between \(E_{\text{GUT}} - E_{\text{Planck}}\). The GAP is the first evidence for the origin of the three Forces \([\text{QED} (\alpha_1) + \text{QFD} (\alpha_2) + \text{QCD} (\alpha_3)]\) being at \(E_{\text{GUT}}\) (the energy of the Grand Unified Theory) many orders of magnitude below \(E_{\text{Planck}}\). This GAP suggests that the gravitational forces are generated before the other three Forces (QED, QFD, QCD).

\textbf{Figure 2}
INVERSE GAUGE COUPLINGS

\[ \alpha_{i}^{-1} \quad [i = 1(QED); 2(QFD); 3(QCD)] \]

The Three Fundamental Forces without the mathematics of the Superworld
Le Tre Forze Fondamentali senza la Matematica del Supermondo

Figure 3
Figure 4: The present status of the unification of the three gauge couplings $\alpha_1 \alpha_2 \alpha_3$ is reported. This is the most accurate description of the unification whose mathematics is in Figure 2.
Figure 5: The GAP between the Planck Energy, $E_{\text{Planck}}$, and the two energy levels, $E_{\text{GUT}}$, where the three gauge couplings converge and $E_{\text{SU}}$, the energy where the RQST (Relativistic Quantum String Theory) puts the origin of the Gravitational Forces. The Gran Sasso is the biggest underground Lab to study neutrinos and cosmic energies of extremely high values.
Figure 6
November 1976 – WASHINGTON

BB1 \rightarrow \text{FROM VACUUM TO THE UNIVERSE} \Rightarrow \text{SUPERWORLD}

\text{WITH INERT MATTER}

11 \text{ Bosonic Dimensions, 32 Fermionic Dimensions } = (43)

BB2 \rightarrow \text{FROM INERT MATTER TO MATTER WITH LIFE}

Zichichi c’è l’ha con Darwin \Rightarrow 10^2 \div 10^3

Many secret Labs

The Problem of Minimal Life

BB3 \rightarrow \text{FROM MATTER WITH MINIMUM LEVEL OF REASON (NEEDED FOR LIFE) TO MATTER WITH THE HIGHEST LEVEL OF REASON} \Rightarrow \text{REASON}

The Meaning of Big Bang

Phase Transition (examples: Ice, Water, Vapour)

Language (Written Language = permanent collective memory),
Rigorous Theoretical Logic (Mathematics) and
Rigorous Experimental Logic (Science).
This extremely successful name given to the Schwarzschild solution of the Einstein equation produced the effect of neglecting the fundamental meaning of the Schwarzschild formula which establishes between the radius of the horizon \( R^{PM} \) of a point-like massive (PM) object and its mass \( M^{PM} \) a very important coupling:

\[
R^{PM} = \frac{2G M^{PM}}{c^2} \approx 1.5 \cdot 10^{-28} \cdot \text{cm} \cdot \text{g}^{-1} \cdot M^{PM} \quad (1)
\]

The Universe Density must decrease with \( M^{-2} \).
The Mass and the Vacuum of our Universe

We would like to understand the origin of the mass and of the vacua of our Universe on the basis of the Planck fundamental constants and the Schwarzschild solution of the Einstein equation.

The fact that the Schwarzschild equation \([1]\) allows to get the value for the mass and the vacua of our Universe when, starting from the Planck Universe, its radius increases by 62 powers of ten, cannot be a casual coincidence, but the result coming from the Evolution of the Universe.

We know that the structure of our Universe has the Galaxies concentrated along lines and planes immersed in very large amount of empty spaces.

The first of these empty spaces was discovered in 1981 in the Boöte constellation. It is estimated that about 98% of the Universe volume is empty.

The reason why these empty spaces must exist is the consequences of its evolution.

We find that the evolution is described by the Schwarzschild equation \([1]\) which predicts that the density of the Universe must decrease with the square of its mass.

The evolution of the Universe is illustrated in Figures 8 and 9 whose origin is in the intellectual venture whose author is Max Planck [2].
Figure 8: The Schwarzschild law between the radius of the gravitational horizon and the mass from the smallest to the largest SCH–object.
Figure 9: The relation which exists between the value of the SCH radius ($R_{\text{SCH}}$) and the corresponding density ($\rho_{\text{SCH}}$), from the smallest (the Planck Universe) to the largest SCH–object (the Universe now).
The Evolution of the **Universe**: from the Planck Universe to our Universe Now with its **Mass** (Figure 8) and **Density** (Figure 9).

Nessuno sa spiegare né la Massa né la Densità dell’Universo.

C’è una sola possibile risposta: *Schwarzschild solutions of Einstein Equation.*
Figure 12
Figure 13
Jet engines outside the structure of the airplane

Jet engines inside the structure of the airplane

Figure 15 – Freehand sketch by the author to illustrate the positioning of jet engines in an airplane.
Figure 16