SUPERFORCE – the Fundamental Force of Unification

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It is found that it is the Planck Force (c^4/G) that is the ruling force of unification, named the Superforce, which also is found in the field equations of Einstein's General Relativity (GR) theory. In this manner, the Superforce unites the world of the very small (quantum field theory) with the world of the very large (GR), thus accounting for a feasible theory of Quantum Gravity. Moreover this Superforce indicates that it is by its very action on the local spatial-temporal geometric structure that Energy Density and hence Matter is created.

I. Introduction

The best theoretical model of physical reality we have to date is known as the Standard Model (SM) of particle physics and it describes physical observations quite well, however there are several shortcomings to it. For example, the SM does not explain the origin of dark matter, nor does it explain the origin of neutrino masses. However its greatest failure is its inability to account for the unification of the four known fundamental forces, including gravity [1-5].

This fact may be due to the best model of gravity being a non-linear theory described by General Relativity [6], while quantum field theory from which SM sources is based on the linear theory of quantum mechanics. Hence a theory of Quantum Gravity is not given by SM, thus letting us pose the question: What if Unification of the Forces is not achieved by 'Quantizing the gravitational field' nor by 'Geometrizing Quantum Spacetime', but by something completely different, namely the Superforce.

II. A Path to Quantum Gravity (QG)?

If you carefully observe Einstein's gravitational field equations (General Relativity (GR)) , you note that the stress-energy tensor is coupled to the geometry of curved spacetime by a scalar factor, on the order of (G / c^4), where G is the universal gravitational constant and c is the speed of light in a given medium.

A simple dimensional analysis shows that the inverse of this coupling scalar constant has the units of energy divided by length, thus as an energy gradient the scalar (c^4 / G) has the units of a Force – we shall call it the Superforce (S_F) . Mathematically, GR can be re-written as $G_{uv} \sim [1 / S_F] T_{uv}$, where G_{uv} is the Einstein tensor and T_{uv} is the stress-energy tensor.

Moreover, if you carefully look at the mathematical structure of the Planck Force, you realize that this is the Superforce, and it does not contain h–bar, namely the modified (reduced) Planck constant, therefore it can relate to a quantum phenomenon exhibiting Macroscopic classical behavior, namely a Macroscopic Quantum Phenomenon.

$$S_F \sim m_P c^2 / L_P \sim M_U c^2 / R_U \tag{1}$$

Equation 1 shows that the Superforce equals the Energy gradient for both the Planck scale and the Horizon (Cosmic) scale in that $S_F \sim 10^{44} \sim (10^{53} \, 10^{17}) / 10^{26}$, where M_U , R_U are the mass and radius of the observable Universe. This fact can not be a mere coincidence and shows that indeed the Superforce acts as the Bridge between General Relativity and Quantum Mechanics, namely the Realms of the very large and that of the very small (QG).

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III. Force of Unification

Consider the relation ($F_{SN}/F_{EM} = 1/\alpha$), where F_{SN} is the strong nuclear force, F_{EM} is the electromagnetic force and α is the fine structure constant, approximately equal to 1/137.

We can write $F_{SN} = (1/\alpha) F_{EM}$ and by recalling that $\alpha = q^2 / (k h^*c)$, where q is the electric charge, h* is h-bar, namely the modified (reduced) Planck constant, and k is the constant ($4\pi \varepsilon_0$), and also that $F_{EM} = (1/k) q^2 / L^2$, then at the Planck scale (namely $L^2 = L_P^2 = Gh^*/c^3$) we obtain $F_{SN} = c^4 / G$, namely the formula for the Superforce (L_P being the Planck Length; ε_0 is the electrical permitivity of free space).

Furthermore, considering $F_G = (Gm_P^2 / L_P^2)$, where F_G is the gravitational force at the Planck scale, namely ($m^2 = m_P^2 = h^*c / G$) we obtain $F_G = c^4 / G$, once again the formula for the Superforce (m_P is the Planck mass).

Therefore this simple yet elegant proof shows that the strong nuclear force equals the gravitational force which further equals the Superforce at the Planck scale. Since the strongest of the known forces equals the weakest of the forces at the Planck scale, this proves that the Superforce is indeed the Force of Unification.

IV. Finding the Superforce in the Schrodinger and Dirac Equations

Consider the Schrodinger Equation written as:

$$ih^*d\psi/dt = -(h^{*2}/2m) \, d^2(\psi)/dx^2 + V\psi \tag{2}$$

where ψ is the wave function of a particle of mass m travelling through a field of (potential) energy V.

This mathematical formalism does not take into account special relativity, which when considered by coupling Equation 2 with the total energy relation ($E_T^2 = m_0^2c^4 + p^2c^2$) yields the Dirac equation (where p is the momentum of a particle of rest mass m_0).

We can think of the structure of equation 1, and re-write it as $[x] = [y] + [z]$, with these respective terms given as the corresponding terms of equation 1. Performing a simple dimensional / scaling analysis on the previous relation we note that from $[x] \sim [z]$ we obtain $V \sim h\omega$, considering that t (time) $\sim 1 / \omega$. This expression for V is the Planck-Einstein relation (wave-energy theory), ω being the vibrational frequency of the particle.

Moreover by considering $[x] \sim [y]$ we can obtain $\lambda \sim h / mv$, namely the De-Broigle wavelength of the particle, where v is the velocity of the particle of mass m, and L_R (reference length) is written as (v)(t), also given that $L_R = \lambda$.

Furthermore, by considering $[y] \sim [z]$, given that the Superforce (S_F) can be written in gradient form as V / L_R and that the Planck Length (L_P) = L_R we can obtain the relation $S_F \sim (c^4 / G)$, since $(1/ dx^2) \sim 1 / L_R^2 \sim 1 / L_P^2$.

Thus we see that the Superforce relation arises in the Schrodiger equation and hence in the Dirac equation, once special relativity is brought into play.

V. Engineering the Superforce ?

Consider the (linearized) relation $[c^2 = 1 / (\mu_0\mu\varepsilon_0\varepsilon)]$, such that μ_0 and μ are the vacuum and non-vacuum magnetic permeabilities and ε_0 and ε are the vacuum and non-vacuum (dielectric constant) electric permitivities, respectively; in this case c is the speed of light in a non-vacuum medium (that is μ and ε are not equal to 1).

Given the fact that the Superforce can be written as (c^4 / G) we can see that by engineering the electric permitivity and the magnetic permeability of a given medium, we can engineer the Superforce itself. This realization has great potential insofar as affecting the very nature of our reality at the most fundamental level. The military and commercial implications of this fact are unbounded, to say the very least.

VI. Conclusion

To recap, the Superforce is the Planck Force, hence it represents the energy gradient at Planck scales, thus it can be written as Planck energy divided by Planck length. Therefore the Superforce is quantum in nature,(and thus fundamental), even though the modified (reduced) Planck constant 'h-bar'), does not feature in its mathematical formalism. In a nutshell, in view of the possible existence of the Superforce (which equals the Planck Force and exists at every point in Space and Time at the Planck scale) General Relativity, may have a new interpretation, namely Einstein's Gravitational Field Equations can be re-arranged to state that: **I***t is the Superforce that when acting locally on the SpaceTime Geometric Structure gives birth to Energy Density, hence generates Matte***r.**
This may mean that the Cosmos is filled with a Superfluid-like 'Substance' [7].

References

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