

On the Existence of the Superforce – the possible Fundamental Force of Unification

Salvatore Cezar Pais¹

Department of the Navy, NAVAIR/NAWCAD, Navy WOLF

It was the German physicist, co-founder of Quantum Mechanics, Max Planck who in 1944 at a conference in Florence, Italy, stated that, “*All matter originates and exists only by virtue of a FORCE which brings the particle of an atom to vibration and holds this most minute solar system of the atom together...*”. Indeed, 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. The Mother of All Forces

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 \hbar , namely the modified (reduced) Planck constant, therefore it can relate to a quantum phenomenon exhibiting Macroscopic classical behavior, namely a Macroscopic Quantum Phenomenon.

The fact that the Planck Force which accounts for quantum mechanical (QM) behavior is found in the mathematical formalism of General Relativity (GR) should give us cause for pause, since the world of the very large, namely GR should not merge with the world of the very small namely QM, at least according to the SM formalism. Thus it may be that the Superforce represents the bridge between these two seemingly disparate realms, and thus as the force of unification be named the Mother of All Forces (MOAF).

¹ Aerospace Engineer, NAVAIR / NAWCAD, Navy WOLF, St. Inigoes, MD. - AIAA member

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 ($4\pi \epsilon_0$), 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 permittivity 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:

$$ih^*d\psi/dt = -(h^*/2m) d^2(\psi)/dx^2 + V\psi \quad (1)$$

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 1 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 Schrodinger equation and hence in the Dirac equation, once special relativity is brought into play.

V. Engineering the Superforce

Consider the (linearized) relation [$c^2 = 1 / (\mu_0\mu\epsilon_0\epsilon)$], 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 permittivities, 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 permittivity 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. Moreover, one additional indication that the Superforce is Real, is the fact (shown with numerical calculations using quantum field theory via the Summit Supercomputer) that inside the proton the pressure is higher than that inside of a Neutron Star (more than 10 to the power of 35, Pascals) - this fact exemplifies that the Superforce is representative of Real Physics. Recall that the magnitude of the Superforce is on the order of 10 to the power of 44, Newtons (Superforce = (c^4 / G) = 10^{44} N).

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: ***It is the Superforce that when acting locally on the SpaceTime Geometric Structure gives birth to Energy Density, hence generates Matter.***

This may mean that the Cosmos is filled with a Superfluid-like 'Substance' [7].

Thus, this New Perspective on Old Physics can talk to a possible Multiverse Concept, giving strength to the idea that the Eridanus Supervoid (within the CMB) may be a 'Window' of one Universe into another, thus allowing the perception of a Multiverse---What if the Superforce in the 'other' Universe had the same magnitude but acts opposite in direction to the Superforce in ours?---at this 'null point' possibly an 'Ashtekar Bounce' point (quantum bounce at Planck scales) [5] the Supervoid is created---a 'local' tearing-apart of the SpaceTime continuum---namely a Supervoid within the Vacuum.

Acknowledgments

On May 8, 2020, I e-mailed the Office of Counsel at Navy Strategic Systems Programs (SSP), where I was working at the time, with the Subject line: "Discovery of Superforce - Force of Unification - The VES Force - disclosure by S.C.Pais". The SSP Public Affairs Officer declined to make the conceptual discovery of the Superforce public, saying that this official disclosure is not a work product of Navy SSP, since it is not in line with the Navy SSP mission ; VES stands for Vacuum Energy State - this is the dynamic quantum vacuum, from which Spacetime emerges (think of the term State, as Structure).

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References

1. S. Bertolini, L. Di Luzio, and M. Malinsky, Phys. Rev. D85, 095014 (2012), arXiv:1202.0807[hep-ph].
2. H. Georgi, and S. L. Glashow, Phys. Rev. Lett. 32, 438–441 (1974).
3. H. Fritzsch, and P. Minkowski, Ann. Phys. 93, 193–266 (1975).
4. H. Murayama, and A. Pierce, Phys. Rev. D65, 055009 (2002), hep-ph/0108104.
5. J. Armas, Conversations on Quantum Gravity, Cambridge University Press, 2021.
6. E. Schrodinger, Space-Time Structure, Cambridge University Press, 1950.
7. K. Huang, A Superfluid Universe, World Scientific Press, 2017.